

DEPARTMENT OF AGRICULTURE, CEYLON.

---

ANNALS  
OF THE  
ROYAL BOTANIC GARDENS,  
PERADENIYA.

EDITED BY

T. PETCH, B.A., B.Sc.

---

VOLUME VII., PART III., OCTOBER, 1921.

---

CONTENTS.

|                                                                                                           | PAGE |
|-----------------------------------------------------------------------------------------------------------|------|
| PETCH, T.—Studies in Entomogenous Fungi: II.—The Genera<br><i>Hypocrella</i> and <i>Aschersonia</i> .. .. | 167  |

---

Colombo :

H. R. COTTLE, GOVERNMENT PRINTER, CEYLON.

London :

DULAU & CO., 34-36, MARGARET ST., CAVENDISH SQUARE, W.

[All rights of Reproduction and Translation reserved.]

Price Eight Rupees.

# DEPARTMENT OF AGRICULTURE, CEYLON.

---

## THE ANNALS.

THE subscription rate is, for regular residents in Ceylon, Rs. 2·50 per annum, post free, payable in advance to the DIRECTOR OF AGRICULTURE, Peradeniya ; for residents in other countries, Rs. 6 per annum, post free, payable in advance to the above, or eight shillings, payable to Messrs. DULAU & Co., 34-36, Margaret st., Cavendish Square, London, W.

The "Annals" appear at irregular intervals, as matter is ready for publication. Individual numbers or papers may be purchased from the DIRECTOR OF AGRICULTURE, PERADENIYA, or from Messrs. DULAU & Co., at prices exceeding the subscription rate.

---

## THE BULLETINS.

BULLETINS of the DEPARTMENT OF AGRICULTURE, which contain articles on planting, agricultural, and horticultural topics, are published from time to time. These take the place of the Circulars formerly published. The subscription is Re. 1 per annum, post free, in Ceylon, and Rs. 2·50 per annum, post free, abroad.

---

## NOTICE TO CONTRIBUTORS.

All contributions should be addressed to the BOTANIST AND MYCOLOGIST, Peradeniya, Ceylon. They should be typed on one side of the paper only ; figures should be ready for reproduction, and planned so as to fill a plate properly.

Each contributor is entitled to receive gratis fifty separate copies of his Paper.

STUDIES IN ENTOMOGENOUS FUNGI:  
II.—THE GENERA *HYPOCRELLA* AND *ASCHERSONIA*.

BY

T. PETCH, B.A., B.Sc.

---

CONTENTS.

|                                            |
|--------------------------------------------|
| Introductory.                              |
| Aschersonia.                               |
| Hypocrella.                                |
| The relation of Hypocrella to Aschersonia. |
| Structure.                                 |
| The Perithecia.                            |
| The Pycnidia.                              |
| Association with Insects.                  |
| Distribution.                              |
| Classification.                            |
| Systematic Account.                        |
| List of Species.                           |
| Key to the known Species.                  |
| Lecaniicolæ.                               |
| Aleyrodiicolæ.                             |
| Species non visæ.                          |
| Species dubiæ.                             |
| Species excludendæ.                        |
| Bibliography.                              |

---

INTRODUCTORY.

THE genera *Hypocrella* and *Aschersonia* include species of fungi which occur superficially on the leaves and stems of living plants. *Hypocrella* is ascigerous and belongs

Annals of the Royal Botanic Gardens, Peradeniya, Vol. VII., Part III., October, 1921.

to the *Hypocreaceæ*, while *Aschersonia* is pycnidial and belongs to the *Nectrioidaceæ*. It was originally supposed that the species of these genera were parasitic on the plants on which they occurred, but about twenty years ago it was discovered that certain species of *Aschersonia* were not parasitic on the plants, but on insects infesting the plants. Further investigations have shown that this is true, not only of all species of *Aschersonia*, but also of all species of *Hypocrella*, a genus whose members bear a striking resemblance to those of *Aschersonia*. Moreover, the opinion has become general that *Aschersonia* is merely the pycnidial stage of *Hypocrella*, and the accumulated evidence on this point is now so strong that the correctness of this view cannot be doubted.

These entomogenous fungi are parasitic, as far as has been determined, only on insects belonging to the *Lecaniidæ* and the *Aleyrodidæ*. The species exhibit at least one point of difference which is correlated with the division of insects on which they are parasitic, and they may accordingly be conveniently divided into two groups, the *Lecaniicolæ* and the *Aleyrodiicolæ* respectively.

The foundation of the present account of these genera was based on a collection of entomogenous fungi which had been amassed by Mr. E. E. Green, formerly Government Entomologist of Ceylon, and the well-known authority on *Coccidæ*. It has since been extended by the examination of numerous gatherings made in Ceylon during the last fifteen years; of the type specimens in the principal European Herbaria; and of collections which have been generously lent by mycologists in the tropics and by specialists who have contributed to the investigation of the tropical fungus flora. My thanks are due to the Directors and officers in charge of the herbaria of the Royal Botanic Gardens, Kew; the British Museum (Natural History); Berlin; and Paris, for the opportunities afforded me of examining the species of these genera in those collections; to Professors von Höhnelt, Ito, Möller, Patouillard, Penzig, Raciborski, Saccardo, Spegazzini, H. Sydow, Theissen, and A. Zimmermann for the loan of types; and to Dr. E. J. Butler, Mr. F. W. South, Mr. H. S. Fawcett, and Dr. E. D. Merrill for general material. Professor Thaxter has liberally



placed at my disposal an extensive collection of West Indian species, which has furnished several stages hitherto unrecorded.

#### ASCHERSONIA.

The genus *Aschersonia* was established by Montagne in 1848 (Ann. Sci. Nat., Ser. 3, Bot., X., p. 122) for the reception of two phylogenous fungi from the tropics. His generic description is as follows :—

“Stroma carnosum, e cellulis tubulis flexuosis intricatis contextum, læte coloratum, primitus velo fugaci byssino concolori tectum. Perithecia membranacea, tenuissima, erecta, fibroso-cellulosa, in basidia abeuntia porisque late apertis (tandem rimose confluentibus) pertusa. Basidia filiformia sporas suffulcientia fusiformes hyalinas triseptatas seu sporulas quaternas foventes.—Fungi phyllogeni, tropici, *Hypocreis* affines.”

He added that the genus represented, in the *Hypocreaceæ*, the tribe which in the *Sphæriaceæ* is distinguished by the absence of asci, that is, in which the spores are borne on basidia, and stated that it was near the *Phyllostigma* of Persoon, which approached it in structure. It differed from the latter in its elongated, fusoid, quadrilocular spores.

The two species were *Aschersonia taitensis* and *Aschersonia guianensis*, of which the following are the descriptions :—

“*Aschersonia taitensis* Montag. MSS.; stromate hemisphærico, truncato, obtuso, luteo, peritheciis subquindenis erectis minutis, poris per rimulas extus conjunctis. Hab. in pagina superiori foliorum *Cyrtandræ* cujusdam taitensis lecta. Coll. Mus. Par. Parasit. No. 25.

“Descr. Sparsa. epiphylla. Stroma hemisphæricum, basi byssino membranacea expansum, luteum, ætate provectiori vaccinum, intus concolor, 1 ad 2 mm. diametro metiens, semillimetrum altum. Perithecia stromati prorsus immersa, ovoidea, in collum brevissimum attenuata, erecta,  $\frac{1}{3}$  millim. longa, apice poro sensim ampliante pertusa. Basidia filiformia, tenuissima, 20 ad 25 millimillim. longa, primitus sporas sustinentia. Sporæ tandem innumeræ, mucilaginis ope

erumpentes, minutissimæ, fusiformes, utroque fine acutissimæ, 15 millimillim. longæ, vix 2 millimillim. in medio crassæ, hyalinæ, sporulas quaternas intervallis manifestis sejunctas includentes.

“*Aschersonia guianensis* Montag. MSS. Stromate convexo orbiculari luteo, peritheciis erectis periphericis tandem discoideo-apertis, margine orifici exstante, sporis . . . . Hab. in folio ignoto in Guyana a cl. Leprieur lecta. Epiphylla.”

He added that he had not been able to find the spores of the second species, but assigned it to *Aschersonia* from its structure and general appearance. Seven figures were given of *Aschersonia taitensis*. The pycnidia are shown as flask-shaped in section, distinct below, but united by furrows above. The stromata are discoid. The pycnosporos in the figure are three-septate, and the illustration of the hymenium does not show any paraphyses. None of the figures shows a hypothallus, but in the vertical section the stroma is slightly expanded towards the base.

The characterization of the genus was erroneous on two points. There is apparently nothing in the specimens to justify the statement “primitus velo fugaci byssino concolori tectum,” though from the description of *A. taitensis* one would expect the presence of a hypothallus; and the spores are not triseptate, but quadriguttulate, as, indeed, Montagne’s original drawing shows.

In Sylloge Generum Specierumque Cryptogamarum (1856) Montagne republished his description of the genus with slight verbal alterations. In Saccardo, Sylloge Fungorum, III., p. 619, the description reads: “Stroma carnosum, hemisphæricum, turbinatum, v. pulvinatum, læte coloratum, primitus velo fugaci byssino concolori tectum. Perithecia (seu loculi) stromate subimmersa membranacea, tenuissima, erecta, fibroso cellulosa porisque late apertis (tandem rimose confluentibus) pertusa. Basidia filiformia. Sporulæ fusiformes hyalinæ, continuæ, subinde 3-4 guttulatæ spurieque septatæ.—Fungi phyllogeni, tropici, *Hypocreis* affines et paralleli, sed ascis carentes.”

Nine species were listed by Saccardo in *Sylloge Fungorum*, III., p. 619 (1884), eight of which had been described as *Aschersonia*, while the other was a transference from another genus. *A. guianensis* was omitted. By the year 1900 the number of species had increased to twenty-six, but it is rather remarkable that Montagne's erroneous description still held the field. Lindau, for example, in *Engler-Prantl, Naturlichen Pflanzenfamilien* (1900), gives merely a translation of Saccardo's description, stating that the stroma is at first covered by a fugacious veil, and adding that the spores have inconspicuous septa. During the current century the description of new species has proceeded at a more rapid rate, and the total recorded up to the end of 1919 is sixty.

#### HYPOCRELLA.

Species co-generic with those which are now included in the genus *Hypocrella* were assigned by the earlier mycologists to *Hypocrea*. Saccardo in 1878 (*Michelia*, I., p. 322) split off the genus *Hypocrella* and placed in it *Hypocrea discoidea* B. & Br., *Hypocrea Bambusæ* B. & Br., *Hypocrea atramentosa* B. & C., and *Hypocrea semiamplexa* Berk. The new genus was briefly characterized as "Stroma et perithecia *Hypocreaceæ*. Asci octospori (?), sporidia filiformia." In *Sylloge Fungorum*, II., p. 579, a fuller description was given:—

"*Hypocrella* Sacc., *Michelia*, I., p. 322. Stroma carnulosum pulvinatum v. disciforme, v. subeffusum, læticolor v. fuscescens: perithecia stromate immersa v. semiimmersa. Asci cylindracei octospori, sporidia filiformia ascum subæquantia, subinde in articulos dilabentia. Genus *Epichloi* affine, stromate haud armillari diversum."

Ten species were included in the genus in *Sylloge Fungorum*, II. (1883). By the year 1900 this had been increased to about thirty, and at the present time (1919) the number of species recorded is seventy (including *Fleischeria* and *Moelleriella*).

Lindau, in *Engler-Prantl, Naturlichen Pflanzenfamilien*, gave practically the same generic description as Saccardo.



## THE RELATION OF HYPOCRELLA TO ASCHERSONIA.

The suggestion that *Aschersonia* is the pycnidial stage of *Hypocrella* was apparently first made by Masee in an account of "*Hypocrella oxyspora*" in the Journal of Botany (1896), p. 151. His statement may be quoted verbatim :—

"The early breaking up of the spores into their component cells, and the subsequent disappearance of the asci, leaving the broken-up spores free in the perithecia, led Berkeley into the mistake of placing the present species in the genus *Aschersonia*. In fact, I am almost certain that I have seen conidia on the surface of young stromata resembling the cells of the broken-up ascospores in form in the present species. On the other hand, an examination of a portion of Montagne's type of *Aschersonia taitensis* Mont., the species on which the genus *Aschersonia* was founded, certainly has (*sic*) the young stromata covered with a dense stratum of fusiform spores; the primordia of perithecia were also very evident in the substance of the stroma, hence in all probability the genus *Aschersonia* will prove to be nothing more than the conidial form of *Hypocrella*; but in the event of this being proved, the name *Aschersonia* should be adopted for the genus, as having priority over *Hypocrella*."

I have not been able to trace any further observations by Masee on this point, but in his Text Book of Plant Diseases (1899) he wrote: "I have shown that species of *Aschersonia*, which hitherto were only known to produce a conidial form of reproduction on living leaves, produce an ascigerous form of fruit, following the conidial stage, on fallen dead leaves."

Though the association of *Aschersonia* with *Hypocrella* is undoubtedly correct, the observations which Masee cited in support of his theory are not accurate. "*Hypocrella oxyspora*" is an *Aschersonia*, as Berkeley described it, and its ascigerous stage was unknown until it was recently collected in Ceylon; the conidia are not produced on the surface of the stroma, but in pycnidia. In *Aschersonia taitensis* the conidia do not cover the surface of the stroma, and the supposed primordia of the perithecia are the pycnidia in which they are produced, as was



described and figured by Montagne. And, further, no case is known in which the ascigerous stage is produced, following the pycnidial stage, on dead fallen leaves.

The first definite proof of Massee's theory was provided by Möller, who found both stages in the same stroma in the case of *Hypocrella cavernosa*. He also observed the occurrence of a pycnidial fungus, whose stromata were similar to those of *Hypocrella phyllogena*, and described it as the pycnidial stage of the latter, stating that such pycnidial fungi had been called *Aschersonia*. He was not able to find the pycnidia and perithecia in the same stroma of the latter species, but he records that Lindau had done so in specimens sent by him. In criticising the generic description of *Hypocrella*, Möller expressed the opinion that it required amendment by the inclusion of the pycnidial stage.

Zimmermann described both stages in *Hypocrella Raciborskii*, and Thaxter has found both in *Hypocrella turbinata*. In the examination of the material described in the present paper, I have found both stages in the same stroma in *Hypocrella discoidea*, *H. Reineckiana*, *H. olivacea*, *H. Mollii*, *H. Sloaneæ*, *H. ceramichroa*, *H. palmæ*, *H. viridans*, *H. palmicola*, *H. epiphylla*, and *H. Andropogonis*.

In the absence of any evidence from pure cultures, the discovery of both stages in the same stroma constitutes perhaps the only valid proof. But once the connection of *Aschersonia* with *Hypocrella* has been established, it may be legitimate to consider as stages of the same species an *Aschersonia* and a *Hypocrella* which occur together and possess identical stromata. The type specimen of *Aschersonia duplex*, for instance, includes exactly similar stromata which contain perithecia, and there can scarcely be any doubt that they are the same species. Again, *Hypocrella javanica* is commonly found in association with *Aschersonia Coffeæ*, and the stromata of the two are alike in colour, hardness, &c.

In *Hypocrella Raciborskii* the ascigerous stroma is generally developed at the margin of the pycnidial stroma. The same happens in *Hypocrella Sloaneæ*, though in both species purely ascigerous stromata also occur. But in the majority of cases in which both stages are known it is not correct to state that

the stroma is at first pycnidial and afterwards ascigerous. When both stages are produced in the same stroma, they occur, as a rule, at the same time ; the stroma is both pycnidial and perithecial. The pycnidia may be developed at the base and the perithecia higher up, and in that sense the pycnidia are the earlier ; but that arrangement is not universal. There is, however, in the majority of cases, no ground for the assumption that, as in so many other fungi, a pycnidial stage is completed before the perithecia appear. Vestiges of effete pycnidia are not usually found in the perithecial stromata, though they may occur, and in some species, *e.g.*, *Hypocrella turbinata*, may be a conspicuous feature.

At present it is not possible to state what factors govern the production of either stage. In one collection all the stromata will be pycnidial, in another all will be ascigerous. The combination of both stages in the same stroma is of rarer occurrence, as would be deduced from the numerous descriptions which refer to one stage only. This rarity, however, may be more apparent than real, for in many cases it is not possible to determine by mere inspection in what stage a given stroma is. In the Lecaniicolous species the perithecia and pycnidia are scattered practically at random, and unless the whole stroma is sectioned, it is more or less chance whether one finds both the stages if they happen to be present.

No evidence has been found in support of the statement that the *Hypocrella* stage is developed after the leaves have fallen to the ground. Under such circumstances the stromata decay. It is not uncommon to find stromata in process of decay on living leaves.

#### STRUCTURE.

Throughout the genera *Hypocrella* and *Aschersonia* the structure of the stroma is remarkably uniform. It is composed of thick-walled hyphæ, of practically uniform diameter, but intertwined without any definite direction, so that in section one sees some hyphæ in cross section as circular annuli, and others in longitudinal or oblique section in short, straight, or curved, or contorted lengths. The hyphæ vary in different species from 4 to 8  $\mu$  in diameter ; von Höhnelt records a diameter

of 14  $\mu$  in *Fleischeria sclerotioides* (*Hypocrella olivacea*). The lumen is reduced to one-third or one-quarter of the diameter of the hypha, and the septa are inconspicuous. The thickened walls frequently exhibit lamination. Towards the periphery of the stroma the ends of the hyphæ may, especially in the Lecaniicolous species, form a distinct epidermal layer, either pseudoparenchymatous, or of short parallel "cells." In some, more especially the Aleyrodiicolous species, the ends of the hyphæ form a minutely tomentose layer. In the centre of the stroma, at the base, in the position originally occupied by the host insect, the hyphæ, probably those which at first permeated the body of the host, are usually thinner; in many examples of Lecaniicolous species, this region is defined by a red sub-hemispherical zone, or is sometimes entirely red.

As far as has been observed, the hyphæ of the stroma do not penetrate into the leaf on which it occurs. A slight pressure is sufficient to detach the stroma from the plant, a fact which accounts for the loss of specimens of the fungus in many herbarium examples. When detached, it is seen that the base of the stroma in many Lecaniicolous species is not uniform; the outer portion is usually smooth and glabrous, indicating that in that region the constituent hyphæ were merely adpressed to the surface of the leaf; the central portion which marks the position of the host insect is often powdery or rough, and bordered by the red zone previously referred to. This is not a constant feature, but some modification of it can usually be traced. Owing to the looser texture of the central area, a small part may remain adherent to the leaf when the stroma is detached. Thus, both on the stroma and the plant, traces of the previous attachment may persist, and these constitute what I have previously referred to as the characteristic *Hypocrella* "scar."

It will be recognized that the structure of the stroma resembles that of a sclerotium. The hyphæ are irregularly intertwined, have thickened walls, and are fused together into a compact mass. This is, perhaps, to be correlated with the habit of these fungi. They are parasitic on scale insects, not on the plant on which they occur. They are not able, therefore, to obtain water from the plant, as are fungi which



are actually parasitic on the latter, but must depend for their supply on the rain or dew which falls on the leaf. They must, therefore, be adapted to withstand periods of drought.

In general the stroma is solid, though in some of the *Aleyrodiicolæ* the hyphæ are somewhat loosely interwoven, and a section shows numerous interspaces. Species which have been described as "eroso-excavatis" prove, on examination, to have been hollowed out by insects (? beetles). In most of the available specimens of *Aschersonia Tamurai*, however, a small hollow space occurs in the centre of the base, without any evident sign of insect injury.

As a rule, the stromata of the Lecaniicolous species are harder than those which are parasitic on *Aleyrodidæ*. This is due to the more compact arrangement of the hyphæ, and, in part, to a greater thickening of the walls of the hyphæ in the former. This feature, however, cannot be employed as a generic character, as in the genus *Fleischeria* proposed by Penzig and Saccardo, since, apart from the difficulty of establishing standards of hardness, it would necessitate the separation in different genera of species which are undoubtedly co-generic. All grades of hardness exist, among the Lecaniicolous species, from *Hypocrella Schizostachyi*, the hardest species known, to *Hypocrella convexa*, which is no harder than many of the *Aleyrodiicolæ*, and it is not possible to define the degree of hardness which would qualify a species for inclusion in the genus *Fleischeria*.

In some cases the lumina of the hyphæ are filled with yellow globules, *e.g.*, in some collections of *Hypocrella Reineckiana*. This, again, is not a constant feature of any species, and there are indications that it varies according to the age of the stroma. The stroma is not gelatinous, *i.e.*, it does not absorb moisture and swell up when wetted. The contents of the hyphæ stain with cotton blue, but the walls do not.

In many species an extremely thin layer of hyphæ borders the base of the stroma, sometimes extending from it for one or two millimetres, closely applied to the surface of the leaf. It may be tomentose, its hyphal structure being clearly evident under a slight magnification, or the hyphæ may be fused into a membranous transparent film. It appears an

outgrowth from the basal portion of the stroma, but a series of developing specimens seems to indicate that it is part of the initial development of the fungus, the central portion becoming thicker later. This structure has received the name of "hypothallus." It does not underlie the whole stroma, but forms merely a border at its lowest edge; an apparent exception to this rule has been found in *Hypocrella bispora*, in some examples of which a thin, white, tomentose layer *underlies* the stroma and projects beyond it, but it appears doubtful whether this is really a part of the *Hypocrella* stroma.

Unfortunately the hypothallus is not a constant feature of any species, and cannot be employed to separate them. It is usually present in *Aschersonia placenta*, but it may be present or not in specimens on the same leaf. In general the presence of a hypothallus is usual in the species parasitic on *Aleyrodidæ*, but rare in those parasitic on *Lecaniidæ*.

Among the characters of the genus *Aschersonia*, Montagne included the presence, in the early stages, of a universal veil or covering which disappeared with age, and in this he has been followed by quite recent writers. But no such structure exists. One is inclined to suppose that Montagne assumed this character from the presence of a hypothallus, but no hypothallus is present, as far as I was able to discover, on the type specimens of either of his species. Nor are the specimens mouldy, as is the case with the type of *Hypocrella epiphylla*, in which the surrounding circular patch of mould has been described as a hypothallus.

The term "hypothallus" appears to have been employed in a very loose manner by the describers of species of *Aschersonia* and *Hypocrella*. It should denote a thin film or layer of hyphæ surrounding the base of the stroma, which appears quite distinct in character from the tissue of the stroma. On the other hand, many scutate or flattened stromata thin out regularly towards the margin, but the tissue of the stroma is evidently of the same character right up to the edge. In these latter cases, it is not correct to designate the thin edge a hypothallus.

The stromata are, in general, white, or brightly coloured in various shades of yellow, red, or brown. *Hypocrella bispora* is rather an exception, the specimens available being purple-brown or purple-black. In many species the colour is not constant, e.g., *H. mollii* may be either white or pale yellow, *H. discoidea* orange-red or yellow, &c. The colouration often extends from the exterior to a depth of about 0·25 mm., forming a distinct peripheral zone; this is well marked in ascigerous examples of *H. olivacea* and *H. palmicola*, and in the *Aschersonia* stage of *H. javanica*. As a rule, the colour is soluble in alcohol, and hence specimens preserved in alcohol are usually bleached.

Sections of the stromata treated with caustic potash change colour or give a coloured extract. Notes on these changes are given in the descriptions of the species. *Hypocrella olivacea* usually yields a yellow-brown extract, and *Hypocrella javanica* and *Hypocrella ceramichroa* a purple extract or colouration. But in other species this effect may vary with the condition of the stroma, as it does in many tropical species of *Hypoxyton*. In *H. Reineckiana* some specimens do not change colour, others may yield a yellow-brown extract from the perithecia, while others turn purple in patches. These changes are most evident in the Lecaniicolous species. In the case of the species parasitic on *Aleyrodidæ*, the colour changes with potash are usually slight, though the presence of a minute fragment of the insect may induce a totally different result; a black *Aleyrodes*, which is commonly attacked by these fungi in Ceylon, yields a vivid colour with potash.

Apparently most species, but especially those parasitic on *Lecaniidæ*, turn black when old, independently of the growth of *Meliola*, &c., over them. And in this connection age is to be taken in its literal sense, not as indicating that the stroma has ripened its spores. Blackened stromata may be quite immature, the development of such having probably been arrested by adverse weather conditions. Many of the pale-coloured Aleyrodiicolous species turn green, especially round or in the ostiola; the cause of this has not been ascertained. In some specimens of *Hypocrella Mollii*, collected in Ceylon, the ostiola are green on one half of the stroma, and



the normal yellow-brown on the other. *Aschersonia viridans* owes its name to this colour change.

The situation of the fungus, whether epiphyllous or hypophyllous, depends upon the position of the host insect, and is not of specific value. If a given species of insect were always confined to one position, and a given species of *Hypocrella* were parasitic only on one species of insect, then the information might in some instances serve to differentiate between species; but neither of these conditions is true.

### THE PERITHECIA.

The perithecia are immersed in the tissue of the stroma. Even in cases where they appear to be more or less superficial, as in *Hypocrella Raciborskii*, there is a region of stromatic tissue surrounding the perithecium proper. In general, the perithecia are flask-shaped, and vary, between species, only in size and the relative lengths of the neck and body.

The wall of the perithecium is distinctly differentiated from the ground tissue of the stroma. It is, as a rule, from 20 to 30  $\mu$  thick, and is composed of more or less parallel hyphæ, densely compacted, running lengthwise of the perithecium. These hyphæ are narrower than those in the body of the stroma, and their walls are less thickened. The wall of the neck is usually thicker than that of the body of the perithecium and towards the apex it increases still more in thickness, so that the apex is expanded obconically. The upper face of the neck, which constitutes the ostium, is either flat or slightly conical, its edge in either case being level with the general surface of the stroma. The term "ostiola projecting," employed in descriptions of these fungi, must be understood to mean that the ostium is situated in a slightly elevated projection of the stroma, the elevation of the actual perithecial tissue being almost too slight to be noticed macroscopically.

The wall of the perithecium contrasts strongly with the tissue of the stroma. It differs, as a rule, from the wall of the pycnidium, and hence there is little difficulty in deciding from sections whether a given specimen is *Hypocrella* or *Aschersonia*, even when the perithecia are quite immature. The ostium

appears translucent when viewed under a slight magnification, and sometimes serves to indicate the character of the stroma without cutting sections, but it requires considerable practice, in many cases, to distinguish it from the translucent mass of spores which fills the orifice of a pycnidium.

The asci are at first long and cylindric, with a short tapering pedicel. The apex is thickened, and forms a distinct cap. In general, the ascus contains eight filiform spores, almost as long as the ascus, wound in a long spiral, but in some cases only two or four spores are produced. The spores become septate, and then divide into short cylindrical lengths, which in many cases subsequently increase considerably in breadth, and become barrel-shaped or oval. During these changes the breadth of the ascus notably increases. When the part-spores are first formed, they retain their original position, and the ascus, though broader, is still cylindric; but ultimately the arrangement of the part-spores becomes quite irregular, and the ascus is then more or less clavate. It is not uncommon to find individual asci which present either the first and second, or the second and third, stages of development of the spores, with a corresponding difference of diameter in their upper and lower parts. Presumably the part-spores are liberated by the complete deliquescence of the asci; I have not been able to discover any sign of dehiscence. Paraphyses have not been observed in the perithecia of *Hypocrella*.

The part-spores are, in general, rod-like with rounded ends, or narrow-oval, or barrel-shaped. Owing to the changes in shape which they may undergo subsequent to their first formation, it is difficult to be sure that one has, in any given case, the final form before him. One of the most remarkable features of the genus is the scarcity of the mature *Hypocrella* stage. In the majority of the species described the asci have been immature, and the same is true of most of the collections made in Ceylon during the last fifteen years.

The differences between the available ascospores of different species are very slight. *Hypocrella phyllogena* constitutes an exception in some of its forms, but the distinction is not constant. In some collections of this species the part-spore

is inflated in the middle, as figured by Montagne. Other collections, however, have merely oval part-spores, and it is possible that the former shape is only a transient phase. Alternatively, it may possibly be related to the difference in the winding of the ascospores which occurs in this species.

Möller collected specimens of *Hypocrella phyllogena* in Brazil and sent them to Bresadola, who described them as the type of a new genus, *Moelleria* (1896), which was subsequently modified to *Moelleriella*, owing to the previous existence of a genus of *Diatomaceæ* bearing the former name. The new genus was distinguished by having its asci polysporous originally, whereas in *Hypocrella* the asci at first contain two to eight long filiform spores. That decision was strongly combated by Möller, who maintained that Bresadola's *Moelleriella sulphurea* was a true *Hypocrella*, having eight-spored asci, and was, in fact, identical with *Hypocrella ochracea* Mass. and *Hypocrella Edwalliana* P. Henn.

In 1897 Saccardo and Lindau contributed to Hedwigia (Vol. XXXVI.) a paper entitled "Elenchus Fungorum Novorum," in which they stated of *Moelleria* that it was "Genus judicio cl. Möller omnino dubium et delendum," and pointed out that in any case the name must be changed. In the same volume (p. 223) Hennings, in describing *Hypocrella Edwalliana*, whose eight ascospores divided into part-spores in the ascus, wrote that Möller had informed him that the same condition obtained in *Moelleria sulphurea* Bres., and therefore the latter genus was identical with *Hypocrella*.

These statements evoked a lengthy and vigorous rejoinder from Bresadola, in which he upheld his previous description. Moreover, he had examined a specimen of *Hypocrella Edwalliana* furnished by Hennings, and declared that in that, too, the asci were polysporous. "Etiam in ascis junioribus sporas filiformes non vidi, sed tantum elementa sporarum quæ insuper neque ad lineam disposita, sed prorsus inordinate in asco jacebant." Further, he had sent specimens of *Hypocrella Edwalliana* to Saccardo, who agreed that the asci appeared to be *ab origine* polysporous.

I have examined the type specimens of *Moelleriella sulphurea* and *Hypocrella Edvalliana* in Herb. Berlin, and have no doubt that they are, as stated by Möller, the same species. In many cases the asci do appear polysporous from the beginning, but that is not really the case. This species differs from the majority of the species of *Hypocrella* in having its filiform spores wound in a very flat spiral, so that many turns occur in the length of the ascus. This is not a constant feature, even in specimens of the same collection. It would seem that this arrangement of the spores, crossing one another at frequent intervals, has produced the appearance of irregularity and led to the interpretation that the asci are polysporous.

#### THE PYCNIDIA.

The pycnidia exhibit greater variation than the perithecia. In the *Lecaniicolæ* they are usually flask-shaped, or oval, or tubular. In small forms of *Aschersonia cubensis* they are globose, while in larger stromata of that species, and in *Hypocrella cavernosa*, they may be ovoid and flattened parallel to the surface. In *Hypocrella Reineckiana* and *Hypocrella cavernosa* the tubular pycnidia may penetrate almost to the centre of the stroma, and in both these species, as well as in *Aschersonia turbinata*, they may be branched.

The pycnidia of the *Lecaniicolæ* differ from the perithecia in not possessing a well-differentiated wall. The hyphæ of the stroma become more or less parallel and converge towards the pycnidium, and from this palisade layer the basidia arise. In the discoid species of the *Aleyrodiicolæ*, the pycnidia have a wall of parallel hyphæ resembling that of the perithecium, but very thin.

The immature stromata of *Hypocrella Reineckiana* frequently acquire a glaucous "bloom," which rubs off when the fungus is handled. This, as previously stated by Parkin, is due to the production of a superficial layer of conidia. The basidia of this external layer are scattered, not crowded as in the normal pycnidia, and the conidia are rather smaller than the usual pycnospores. This occurrence of conidia on the exterior



suggests that the pycnidia were originally merely depressions in the surface of the stroma; indeed, many of the shorter tubular pycnidia give the impression that they are formed by the development of the basidia on a small area, and the subsequent lag of the growth of that area behind that of the surrounding tissue of the stroma; and the mere flask-shaped or elongated-oval pycnidia could be derived from the tubular form by the constriction of the orifice. But in other cases, e.g., in *Hypocrella olivacea*, the oval pycnidium is formed within the tissue of the stroma. The small forms of *Aschersonia cubensis* show very interesting variations in this respect; in fully-developed forms the apex of the stroma is umbilicate, and the globose pycnidium, which lies within the body of the stroma, opens at its highest point into the funnel-shaped depression. In some immature examples, however, there is no pycnidium in the body of the stroma, but a superficial layer, apparently of developing basidia, at the base of the depression.

In the *Aleyrodiicolæ* the pycnidia may be elongated-oval or almost flask-shaped, as in *Hypocrella Mollii*; or definitely globose or flattened-globose, with a distinct conical neck, as in the discoid species, *Hypocrella discoidea*, *Aschersonia flavocitrina*, &c.; or widely and irregularly open, as in *Aschersonia placenta*, *A. Aleyrodis*, *A. hypocreoidea*, &c. The first two types are formed within the tissue of the stroma; and the pycnidium of the discoid species opens by a distinct pore in the centre of a thin scarious area. But the pycnidium of the third type may originate either superficially or internally.

This latter type of pycnidium is an irregular cavity, circular or oval in plan, usually with a convoluted base. In the case of very thin stromata, such as generally occur in *Aschersonia hypocreoidea*, it is undoubtedly formed superficially, i.e., by the development of basidia on the surface of the stroma. In other species, e.g., *Aschersonia placenta* and *Aschersonia Aleyrodis*, the stromata may vary from mere films to a thickness of 1.5 millimetres, and though the basidia are produced superficially in the former, it is doubtful whether the same is true of the thicker stromata. Webber has described

the formation of the stroma in *Aschersonia Aleyrodis* as follows :—

“The fungus does not spread over the leaf to any extent, but grows upward in a mass, gradually spreading over the larval scale. It is not uncommon to find the perithecia (*i.e.*, pycnidia), with their bright coral-red masses of sporules formed in a circle round the edge of the larva while it is yet visible. As the *Aschersonia* develops, the hyphæ spread over the larva, forming a dense, compact stroma, which ultimately entirely envelops the larva. The stroma in this stage is thin and disc-like, the fructification being usually borne in a circle near the edge. The hymenium at this time is spread out on the surface of the stroma, or but slightly sunken, the sporules projecting in a conical coral-red or rufous mass. As the fungus develops, the stroma becomes thickened and hemispherical, and the hymenium gradually becomes immersed.”

The interpretation is doubtless correct if we accept the view that the thin and thick stromata represent stages of development, *i.e.*, that the thicker stromata were produced by the continued growth of thinner stromata which were already bearing conidia. But that is not necessarily the case. In all probability the thick and thin stromata on a given leaf are all the product of the same infection, and consequently all of the same age, their different thicknesses being due to a difference in vigour of growth. The occurrence of stromata in which the pycnospores are immature, and the pycnidia nearly closed, would appear to show that the pycnidia in the thicker examples are produced within the stroma and subsequently open widely. In pulvinate forms of *Aschersonia placenta* the pycnidia are often oval with a narrow orifice. That the cavity of the pycnidium originates as an invagination of the surface of the stroma is not excluded.

The pycnidia are lined with short, densely crowded basidia. As far as my observations go, the basidia are simple, but Miyabe and Sawada have shown that branched basidia may occur in *Aschersonia Coffeæ*, *A. Tamurai*, and *A. marginata*. The pycnospores are produced singly at the apex of the basidium, and as the pycnidia are, when mature, completely filled with spores, while in some cases a dense mass of extruded

spores also covers the stroma, it would appear that a continuous production of spores takes place from each basidium. When mature, the spores are extruded in coloured masses. In the *Lecaniicolæ* and the discoid species of the *Aleyrodiicolæ* the spore masses from the individual pycnidia remain distinct, as a rule; but in those species of the *Aleyrodiicolæ* which have irregular and widely-open pycnidia, e.g., *Aschersonia placenta*, the spore masses fuse into a continuous covering over the centre of the stroma. The pycnospores adhere strongly to one another and fill the pycnidium with a translucent mass, which is not easily removed. Prolonged soaking in water often fails to loosen the spores sufficiently to permit their evacuation from the pycnidia in a section of the stroma, and it is necessary to employ caustic potash to liberate them before the hymenial layer can be examined. Webber has figured an instance in which the pycnospores were extruded in erect columnar masses in the case of *Aschersonia Alecyrodis*, and I have observed the same in *Aschersonia placenta* kept in a glass dish in the laboratory, but, probably because of the greater humidity of the atmosphere, this phenomenon does not, apparently, occur in the open in Ceylon; the nearest approach to it is the columnar mass of spores, which sometimes crowns *Aschersonia oxyspora*. A comparison of the detached spores within a pycnidium with those in the extruded spore-masses leads to the conclusion that the spores increase in breadth after they have become detached.

The shape of the pycnospores shows very little variation. In general they are fusoid or narrow-oval, with pointed ends. When immature the broadest part is generally situated towards one end, but they become more regularly oval subsequently. In a few cases they show distinctive characters, e.g., in *Aschersonia basicystis* (*Hypocrella phyllogena*), *Aschersonia turbinata*, and *Aschersonia oxystoma*. The pycnospores of *A. basicystis* are usually furnished with fine points, up to  $4\mu$  long, though others, merely narrow-oval, may occur in the same pycnidium. *Aschersonia turbinata* has broadly oval spores, with abrupt short points which appear solid. The spores of *A. oxystoma* appear to resemble those of *A. turbinata*, but the effect is produced by the concentration of the contents into an oval

mass, leaving the tapering ends apparently empty. Vacuolation is common both in pycnospores and ascospores (part-spores), but it is not a constant feature in any species.

The species of *Aschersonia* parasitic on *Aleyrodidæ* differ from those parasitic on *Lecaniidæ* in having long filamentous paraphyses arising with the basidia from the hymenial layer. This difference has been found to exist in all cases in which the host insect has been determined. The paraphyses are not septate, but in many cases they exhibit light and dark lengths, due apparently to a discontinuous variation in their contents. This was recorded by Webber for *Aschersonia Aleyrodis*, and I have noted the same thing in *Aschersonia placenta*, *A. hypocreoidea*, and *A. Goldiana*, but in no case is it constant. The length of the paraphyses is variable, but the range in each species provides a character by which the species can be separated.

#### ASSOCIATION WITH INSECTS.

Webber, in 1894, as the result of his investigations into the fungi and insects on *Citrus*, was the first to demonstrate that species of the genus *Aschersonia* were parasitic on insects. He showed that *Aschersonia Aleyrodis* was parasitic on *Aleyrodes citri* R. & H., *A. turbinata* on *Ceroplastes floridensis* Comstock, and, judging from his description, *A. cubensis* on *Lecanium hesperidum* L.

Several years elapsed before Webber's discovery had any influence on the writings of systematic mycologists. Hennings, when describing five species of *Aschersonia* from Java in 1902, noted their association with scale insects, apparently with some astonishment, and wrote that it was a remarkable phenomenon that these fungi generally occurred with various species of *Lecanium*, to which they bore so great a resemblance in form and colouration that he considered this was to be regarded as an instance of mimicry (Hedwigia, XLI., pp. 145, 146).

Webber had suggested that all species of the genus *Aschersonia* were entomogenous, and that view was supported by Parkin in his paper published in 1906. Parkin recorded eight collections of *Aschersonia* parasitic on species of *Aleyrodes*



and seven on species of *Lecanium*. From the specimens left by him these included *Aschersonia placenta*, *A. confluens*, *A. hypocreoides*, *A. samoensis*, *A. Coffeæ*, and *A. marginata*.

Since 1904 species of *Aschersonia* have generally been described as occurring on scale insects. Hennings described *Aschersonia parasitica* on a coccid on *Andropogon* in 1904, Patouillard described *Aschersonia pisiformis* on a *Coccus* on *Cocos nucifera* in 1906, while Koorders in 1907 enumerated *Aschersonia Eugeniæ*, *Aschersonia Henningsii*, and *Aschersonia lecanioides* as parasitic on scale insects. The position at the present day is that stated by Thaxter: "There can be no question in the mind of any one who has had an opportunity to examine them in a fresh condition that they are strictly entomogenous, like the species of the genus *Hypocrella*, which have a similar habitat on various species of scale insects."

The recognition of the entomogenous nature of *Hypocrella* is of later date. The first species described as parasitic on a scale insect was *Hypocrella Raciborskii* by Zimmermann in 1901.

Parkin in 1904 was of opinion that the genus *Hypocrella* was one which might eventually be shown to be of common occurrence on scale insects. He recorded two collections parasitic on *Lecanium*, now known to be *Hypocrella ceramichroa* and *H. Reineckiana*, respectively, and a third gathering on *Chionaspis vitis*, which is not now available; this last determination was, perhaps, erroneous, as no species has since been found on *Chionaspis*.

Raciborski, in 1906, stated that he had usually found *Hypocrella* parasitic on scale insects, and recorded that habit for *Hypocrella Amomi*, *H. convexa*, and *Burya sulacensis* (*H. Raciborskii*). But Koorders, in 1907, described *Hypocrella Grewiæ*, *H. Mollii*, and *H. Engleriana* without reference to any host, except the plants on which they occurred.

In 1909 von Höhnelt added three species, *Hypocrella cretacea*, *H. bispora*, and *Fleischeria sclerotoides*, to the list of those known to be parasitic on scale insects.

In many gatherings the development of the fungus on the scale insect is quite obvious, as the stroma does not completely cover the scale, but forms a ring round and over the outer edge of it. This occurs, as far as has been observed, only

in the *Aleyrodiicolæ*. It is of frequent occurrence in *Hypocrella discoidea*, *Aschersonia placenta*, and *Aschersonia Zenkeri*, and has been found in immature examples of *Hypocrella Mollii*. The type specimen of *Aschersonia parasitica*, and Diels' specimen of *Aschersonia duplex*, exhibit the same formation. In this group, moreover, it is not uncommon to find traces of the insect in the base of the fully-developed stroma.

In the Lecaniicolous species this annular development of a sporiferous stroma apparently does not occur. But, on the other hand, the stromata frequently develop eccentrically on the scale, so that a portion of the latter is left exposed. This group also differs from the former in that, as a rule, no trace of the scale insect is discoverable within the fully-developed stroma. It is, however, sometimes possible to find in one gathering a series of stages of development, in the more immature of which the scale is still evident, as is the case with Parkin's specimens of *Hypocrella ceramichroa*.

It is necessary to exercise great caution in determining on what insect an *Aschersonia* or a *Hypocrella* is parasitic. It does not follow that, because a certain scale insect is found on a leaf in company with an entomogenous fungus, the fungus is parasitic on that particular insect. Several scale insects may be found together on a single leaf, and if a *Lecanium* and an *Aleyrodes* occur on the same leaf, a Lecaniicolous *Aschersonia* may obliterate all the former, leaving only the *Aleyrodes*. Consequently, the existence of numerous scale insects in company with an *Aschersonia* is rather an indication that the fungus is not parasitic on that insect. The only certain method of identification is to find the early stages of development of the stroma before the insect has been completely covered by it.

In Japan and Formosa it has been recorded that *Aschersonia marginata*, a Lecaniicolous species, and *Aschersonia hypocreioidea*, an Aleyrodiicolous species, have occurred on *Parlatoria zizyphi*. These are the only records of any *Aschersonia* on *Parlatoria*, and, in view of experience in other countries, they would seem doubtful.

The growth of *Aschersonia* and *Hypocrella* on insects having been established, there yet remains the possibility, which has

been propounded on several occasions, that these fungi are not parasitic on the living insect, but merely develop as saprophytes on their remains after death. On this point, Webber's observations appear to be conclusive: "Apparently mealy wing *Achersonia* (*A. Aleyrodis*) attacks the mealy wing only in the larval and pupal stages. The infection probably takes place most abundantly while the larvæ are young. The mature larvæ and pupæ are, however, frequently attacked. At Myers, Fla., June 6, 1895, the writer found *Aschersonia* very abundant in the early stages of development. Most of the larvæ were just approaching maturity. It was at that time almost impossible to find good mature specimens of the *Aschersonia*, pustules which developed on the preceding brood of larvæ, which matured in March, having become old and weather-worn. The first indication of the effect of the fungus on the larvæ of the mealy wing, as observed by the writer, is the appearance of slightly opaque yellowish spots usually near the edge of the larva. In the early stages of infection the larva becomes noticeably swollen, and appears to secrete a greater abundance of honeydew than normally. It is probable, however, that owing to the weakened condition of the larva the honeydew is not expelled with sufficient force, so that as it is slowly discharged it collects about the insect, and this would make it appear that there is an excessive amount . . . .

"As the *Aschersonia* develops, the interior organs of the larva appear to contract away from the margin, leaving a narrow circle, which becomes filled with hyphæ. This circle becomes opaque and whitish, presenting a very characteristic appearance. Shortly after this the hyphæ burst out around the edge of the larva forming a dense marginal fringe. This may form all around the larva at about the same time, or develop at one portion of the margin sooner than at the others. The body of the larva at this time is plainly visible, but it is opaque and yellowish throughout. Death usually ensues, the writer believes, before the hyphæ burst out."

According to Fawcett, the two methods advised by Webber for introducing *Aschersonia Aleyrodis* into orange groves infested with *Aleyrodes citri* met with fair success. These

were (1) pinning fungus-bearing leaves into trees infested with *Aleyrodes citri* in such a way as to cause the fungus spores to come in contact with larvæ not yet infected, and (2) planting small trees with fungus-infected larvæ in a grove, so that the fungus-bearing leaves came in contact with the leaves on which it was desired to start the fungus. Successful introductions of the *Aschersonia* have been obtained by Berger by spraying the spores on the trees infested with the insect. There is, however, an element of doubt in experiments of this kind, which prevents their citation as successful examples of artificial infection. Possibly a better instance is the successful infection of *Aleyrodes vaporarium* by *Aschersonia Goldiana* (misdetermined as *Aschersonia flavocitrina*), accomplished by Stene in the greenhouse at the Rhode Island College of Agriculture, as in that case the possibility of natural infection was remote.

The experiment last cited illustrates a point which is self-evident to any one who has collected any considerable quantity of these fungi in the field, viz., that their parasitism, as far as the available evidence goes to prove, is not specialized. This has been noted chiefly in connection with the commoner Lecaniicolous species, of which a large quantity of material is available. In the case of Ceylon and Eastern collections the host insect has been determined in a number of instances and it is clear from the records that *Hypocrella Reineckiana*, for example, can attack a wide range of species of *Lecanium*.

In America *Aschersonia Aleyrodis*, according to Morrill and Back, has been found to attack *Aleyrodes citri*, *A. nubifera* Berger, *A. inconspicua* Quaintance, *A. floridensis* Quaintance, *A. howardi* Quaintance, and *A. abutilonea* Hald. *Aschersonia Goldiana* is recorded by the same authors as parasitic on *A. citri* and *A. nubifera* only.

Conversely, any given species of *Lecanium* or *Aleyrodes* may be attacked by a number of species of *Aschersonia* or *Hypocrella*. This is indicated by the occurrence of two or more species of these fungi on the same leaf. *Hypocrella olivacea* frequently occurs with *Hypocrella javanica* and *Hypocrella Reineckiana* on *Lecanium oleæ* in Ceylon. *Hypocrella discoidea* is often accompanied by *Hypocrella Mollii*,



or, more rarely, by *Aschersonia placenta*. *Aschersonia badia* usually occurs with *Hypocrella Mollii*. In all these cases there is little doubt that the fungi are parasitic on the same species of insect.

There may, of course, exist cases in which a particular species of fungus is confined to one species of insect, but no evidence in support is as yet available.

#### DISTRIBUTION.

The material of these genera in herbaria is, as a rule, remarkably scanty. One would imagine that in many cases the fungus has been accidentally gathered on phanerogamic specimens collected for distribution, and discovered subsequently in the herbarium. Types frequently consist of a single leaf bearing only two or three examples of the fungus, and in many cases the fungi on the leaf belong to more than one species. It is not to be wondered at, therefore, that in the case of the commoner species the list of synonyms is somewhat lengthy, since the material from which the species was described is often insufficient to give any idea of its range of variation.

The examination of the herbarium collections would lead to the conclusion that species of these genera are rare. But it is not difficult, according to Ceylon experience, to collect large numbers of a species, provided one devotes the time to it. Of course, cases do occur when a single specimen is found, and a thorough search fails to reveal more, but, in general, the systematic examination of a bush or tree on which a specimen has been found will result in the discovery of dozens, or even hundreds. It has to be remembered, however, that the fungus is parasitic on a scale insect, not on the plant, and its parasitism is not specialized. Consequently, a collection from one plant, even if all on the same scale insect, may include several species of *Aschersonia* or *Hypocrella*.

These genera are essentially tropical, no species being known from temperate climates. Several species are found in Florida, but the majority occur within the tropics.

With two exceptions, one of which is doubtful, the species of the Western Hemisphere are distinct from those of the

Eastern. Closely allied species occur in the two regions respectively, e.g., *H. palmæ* and *H. olivacea*, *H. epiphylla* and *H. Reineckiana*, *Aschersonia Aleyrodidis* and *A. placenta*, but they are sufficiently different to be maintained as distinct species. *H. palmicola*, however, has been found in Trinidad and in Madagascar, and the doubtful exception to the rule, *Hypocrella caulium*, is recorded from Brazil and Africa. The stromata of the Brazilian and African collections of the latter species differ considerably in shape, but the variation is not much greater than that which is known to occur in *Hypocrella olivacea*; unfortunately, in none of the collections yet made are the stromata mature.

#### CLASSIFICATION.

The generic descriptions of *Hypocrella* and *Aschersonia* may be revised as follows :—

*Hypocrella*.—Stroma superficial, easily detached, fleshy, sclerotoid, composed of intricate thick-walled hyphæ; brightly coloured, blackening when old; subglobose, hemispherical, or pulvinate. Perithecia usually flask-shaped, immersed, wall distinct from the tissue of the stroma; asci cylindric, capped, two to eight-spored; no paraphyses; spores filiform, almost as long as the ascus, separating into short part-spores within the ascus; part-spores hyaline, continuous, rod-like, or becoming oval. Pycnidial stage, *Aschersonia*, in the same or a similar stroma. Parasitic on *Lecaniidæ* and *Aleyrodidæ*.

*Aschersonia*.—Stroma as in *Hypocrella*. Pycnidia immersed, tubular, flask-shaped, oval, or globose, or widely-open convoluted cavities; basidia simple or branched; paraphyses long and filiform, or wanting; pycnosporangia hyaline, continuous, fusoid or narrow-oval. Parasitic on *Lecaniidæ* and *Aleyrodidæ*.

In general the genus *Aschersonia* has not presented any difficulties to mycological systematists. One or two species have been attributed to *Hypocrea*, but Montagne's description has been sufficient to prevent many errors in generic determination. It may be noted that of Montagne's two species one is *Aleyrodiicolous* and has paraphyses, while the other is apparently *Lecaniicolous*. Montagne's description does not

mention paraphyses, and by universal consent the genus has been held to include species with paraphyses and species without them.

In the genus *Hypocrella* conditions are different, and a number of species have been included in the genus, either by their original describers or by transference, which are plainly not co-generic with *Hypocrella discoidea*. The character relied upon appears to have been merely the presence of perithecia with filiform ascospores immersed in a stroma. In some cases discomycetes have been referred to *Hypocrella*, but the most frequent error has been the inclusion of species of *Balansia*.

The genus *Balansia* Speg., and a few allied genera, comprise a group of species biologically well defined if not easily distinguishable by systematic characters. Most of the species are parasitic on grasses, and form a black stroma, which may be pulvinate, or elongated, or may give rise to stalked stromata with pulvinate or rounded heads. The perithecia are embedded in the stroma, are usually thin-walled, and densely crowded in a distinct peripheral layer. The asci are cylindric and capped, resembling those of *Hypocrella*, but with a slightly longer pedicel, and the ascospores are filiform and almost as long as the ascus. Möller states that the spores of *Balansia ambiens* and *Balansia diadema* are septate, and divide when placed in a nutrient solution; that the spores of *B. regularis* are also septate, but do not divide in the ascus; and that *Balansia redundans* has septate spores. He also states that the spores of *Ophiodothis Henningsiana* (= *Dothichloe*) and *Ophiodothis raphidospora* (= *Linearistroma*) have septate spores, which do not divide within the ascus. I have not been able to observe septa in the spores of the available specimens of *Balansia brevis* (B. & Br.) v. Höhnelt, *B. Panici* (Masse), *B. axillaris* (Cooke) and *B. Bambusæ* (B. & Br.).

In many cases the stroma of *Balansia* seems superficial, e.g., in *Balansia brevis* and *B. Panici*, where it appears to be seated longitudinally along a leaf, or in *B. Bambusæ*, in which it is situated at the apex of a short shoot. Examination of the stroma shows that in the first two cases the stroma completely encloses a lateral shoot, and adheres on one side to the leaf,

from the axil of which the shoot arose. In *Balansia Bambusæ* the stroma encloses the inner leaves of the shoot, and produces an external perithecial portion at the apex. In all cases the tissue of the stroma is composite, being formed partly of fungus tissue and partly of the almost unmodified tissues of the host plant.

*Ophiodothis* Atkinson; according to Atkinson and von Höhnelt, is identical with *Balansia* Speg. Möller included the species with stalked perithecial heads in *Balansia*, and the pulvinate forms in *Ophiodothis*. *Dothichloe* Atkinson differs only slightly from *Balansia*, practically only in the thickness of the stroma, and is scarcely worthy of retention. Similarly, *Balansiopsis* v. Höhnelt and *Linearistroma* v. Höhnelt are scarcely distinct from *Balansia*. If these are retained, it would appear that Möller's distinction between *Ophiodothis* and *Balansia* should hold. *Ophiodothella* v. Höhnelt, originally proposed by Hennings as a subgenus of *Ophiodothis*, appears to belong not to this group, but to the *Dothidaceæ*.

The genera referred to above agree in having a composite stroma, and, with the genus *Claviceps*, they constitute the *Clavicipiteæ*. They differ from *Hypocrella* in the structure and colour of the stroma, and in having filamentous septate spores which do not divide into part-spores in the ascus. It appears to be generally accepted that the genus *Ephelis* includes the conidial stages of *Balansia*, though Möller stated that the conidial stage of *Balansia redundans* had no resemblance to *Ephelis*. Möller obtained a *Cephalosporium* form on the germination of the ascospores of the latter species, but it does not necessarily follow that that is the form which occurs in nature, or that it is the only conidial form of the species. Immature stromata, which probably belong to this group, are common on the inflorescences of grasses in Ceylon; they usually consist of white or grayish mycelium, which binds together the individual spikelets into a continuous mass.

*Dussiella* Pat. has been attributed in part to *Hypocrella*. The genus was founded by Patouillard in 1890 on three collections from widely-separated localities. The first of these, from North America, had been named *Hypocrea tuberiformis* by Berkeley and Ravenel. With this Patouillard joined a specimen from Caracas in Herb. Berlin, and another



from Martinique. Berkeley's specimen was sterile, the Caracas specimen ascigerous, and the Martinique specimen conidiiferous.

In section the ascigerous stroma is seen to consist of superposed concentric zones, and its constituent hyphæ are thickened, refringent, and gelatinous. The perithecia are confined to a zone about 1 mm. thick at one end of the stroma, and their ostiola resemble the pores of a Polyporus. This ascigerous area is surrounded by the remains of a filamentous mycelium. The perithecia are narrow and deep, and contain cylindrical asci and abundant paraphyses. The ascospores are filiform and (?) septate.

The conidial stroma, like the sterile and ascigerous forms, is surrounded by a white mycelium. In section it is found to consist of a white basal part, a cortical zone, and an intermediate softer tissue. The intermediate tissue is composed of numerous tubes which run from the base to the cortex. These tubes are lined with clavate basidia, which bear brown, spherical, verrucose spores, 3  $\mu$  diameter. Patouillard refers to this as a *Ceratomyces* form of the ascomycete.

The details given above are quoted from Patouillard's paper (Bull. Soc. Myc. France, VI., p. 106). In 1891 Atkinson published a paper in which he dissented from Patouillard's determination, and described Berkeley and Ravenel's species as *Hypocrella tuberiformis* (Berk. & Rav.) Atk., nec *Dussiella* Pat. Atkinson described the stroma as stratose, at first clothed with hyphæ, which bear hyaline conidia, 7-10  $\times$  3.5-4  $\mu$ . The perithecia are sessile or with the base immersed, and the ascospores are filiform, multiseptate, finally separating into part-spores.

Rick has recorded further details concerning *Dussiella*. He states that the fungus appears to be merely epiphytic. At first it is white and covered with a conidial layer, but becomes red-brown later. He describes the stroma as white internally, and does not mention any zonation. With regard to the ascospores, he states that they remain undivided even after their extrusion from the ascus. Paraphyses were present in the perithecia. According to Rick, the conidial stage of *Dussiella* belongs to the *Stilbaceæ*.

The discrepancies between the accounts furnished by Rick and Patouillard suggest that these authors were dealing with different fungi. It is, moreover, quite possible that the three collections described by Patouillard were not related. Evidently *Dussiella* requires further investigation on the spot before the various accounts can be harmonized. But in any case it does not appear that any of the fungi described under this name can be referred to *Hypocrella*. The stratose stroma, and the conidial stages described by the three writers quoted, are unlike anything in the latter genus.

The genus *Moelleriella* has already been referred to, and in the opinion of the writer the type specimen, *Moelleriella sulphurea*, is *Hypocrella phyllogena*. Rick has described another species of *Moelleriella* under the name of *M. nutans*, which grew on living stems of *Arundinaria*. He states that it possesses three different kinds of asci. The first contains filamentous septate spores, which are extruded in their undivided condition; this form is rare. The second contains spores which divide into oblong-oval part-spores in the ascus, though they may be extruded in a continuous chain; this is the most usual form. In the third type the "sporeanlange" is filamentous, but divides into part-spores before the formation of a spore wall, and the separate joints develop as independent spores; when ripe the part-spores are oval, or cylindric with truncate or pointed ends.

Rick considers that his new species establishes the validity of Bresadola's genus. But, except for the statements concerning the extrusion of the spores, his description is exactly what would be written by any one who regarded the differences in the asci of *Hypocrella phyllogena* as final stages instead of stages of development. Asci, whose contents could be imagined to answer in every respect to Rick's descriptions, may be found in any collection of *Hypocrella phyllogena* (*Moelleriella sulphurea*). I have examined the specimen of *Moelleriella nutans* in Herb. Berlin (Rick, Fungi Austro-Americani, 89), but was unable to find perithecia or pycnidia in it, and it did not appear to have the structure of *Hypocrella*. Rick describes it as having paraphyses; in that case it differs from *Hypocrella* and from the type of *Moelleriella*.

## SYSTEMATIC ACCOUNT.

The species of *Aschersonia* may be arranged in two groups, according to the presence or absence of paraphyses. And this feature, as far as the species hitherto known indicate, is correlated with the kind of insect on which the fungus is parasitic. Species parasitic on *Aleyrodidæ* have paraphyses; those parasitic on *Lecaniidæ* do not. It is proposed to take these two groups as subgenera, under the names of *Eu-Aschersonia* and *Leprieuria* respectively. *Eu-Aschersonia* has been selected for the Aleyrodiicolous group, because the type species of the genus *Aschersonia*, *A. taitensis* Mont., possesses paraphyses.

The difference between the corresponding species of *Hypocrella* is not so easily defined. The Lecaniicolous group have, in general, harder, more compact stromata than the Aleyrodiicolæ. The stromata of the first group are usually hemispherical, two-thirds globose or scutate, while those of the second are discoid or irregularly flattened pulvinate. The two stages are found in the same stroma, more frequently in the *Lecaniicolæ* than in the *Aleyrodiicolæ*. The type species of the genus *Hypocrella*, *Hypocrella discoidea*, is an Aleyrodiicolous species, and the *Aleyrodiicolæ* may, therefore, be known as *Eu-Hypocrella*. For the harder species of the *Lecaniicolæ* the generic name *Fleischeria* has been proposed by Penzig and Saccardo. While it is not possible to consider hardness as a generic character, the name, as applied by Penzig and Saccardo, denotes a species which differs from *Eu-Hypocrella* in its pycnidial stage by the absence of paraphyses. It is proposed, therefore, to employ the name *Fleischeria* as a subgenus for the species parasitic on *Lecaniidæ*.

## LIST OF SPECIES.

As will be evident from the following list, the *Hypocrella* stage of all the known species of *Aschersonia* of the group *Lecaniicolæ* has been determined; their descriptions have consequently been included with the related *Hypocrella*. On the other hand, the *Hypocrella* stage is known in less than half the Aleyrodiicolous species of *Aschersonia*.

The species of *Hypocrella*, with their corresponding *Aschersonia* stages, may be arranged as follows :—

## LECANICOLÆ.

## HYPOCRELLA.

## ASCHERSONIA.

## Subgenus FLEISCHERIA.

## Subgenus LEPRIEURIA.

|                            |                      |
|----------------------------|----------------------|
| <i>H. palmæ</i> ..         | .. (Not named)       |
| <i>H. epiphylla</i> ..     | <i>A. cubensis</i>   |
| <i>H. Reineckiana</i> ..   | <i>A. marginata</i>  |
| <i>H. caulium</i> ..       | —                    |
| <i>H. ceramichroa</i> ..   | (Not named)          |
| <i>H. cavernosa</i> ..     | (Not named)          |
| <i>H. olivacea</i> ..      | (Not named)          |
| <i>H. scutata</i> ..       | —                    |
| <i>H. convexa</i> ..       | —                    |
| <i>H. bispora</i> ..       | —                    |
| <i>H. verruculosa</i> ..   | —                    |
| <i>H. javanica</i> ..      | <i>A. Coffeæ</i>     |
| <i>H. Gartneriana</i> ..   | —                    |
| <i>H. Schizostachyi</i> .. | —                    |
| <i>H. botryosa</i> ..      | —                    |
| <i>H. Amomi</i> ..         | —                    |
| <i>H. nectrioides</i> ..   | —                    |
| <i>H. turbinata</i> ..     | <i>A. turbinata</i>  |
| <i>H. phyllogena</i> ..    | <i>A. basicystis</i> |
| <i>H. oxystoma</i> ..      | <i>A. oxystoma</i>   |

## ALEYRODIIICOLÆ.

## Subgenus EU-HYPOCRELLA.

## Subgenus EU-ASCHERSONIA.

|                        |                          |
|------------------------|--------------------------|
| <i>H. discoidea</i> .. | <i>A. samoensis</i>      |
| <i>H. viridans</i> ..  | <i>A. viridans</i>       |
| <i>H. palmicola</i> .. | (Not named)              |
| —                      | <i>A. badia</i>          |
| —                      | <i>A. brunnea</i>        |
| —                      | <i>A. flava</i>          |
| —                      | <i>A. crenulata</i>      |
| —                      | <i>A. blumenaviensis</i> |
| <i>H. Mollii</i> ..    | <i>A. confluens</i>      |
| <i>H. duplex</i> ..    | <i>A. duplex</i>         |



| HYPOCRELLA.            | ASCHERSONIA.                      |
|------------------------|-----------------------------------|
| <i>H. tubulata</i>     | .. (Not named)                    |
| —                      | .. <i>Aschersonia columnifera</i> |
| —                      | .. <i>Aschersonia acutispora</i>  |
| —                      | .. <i>A. taitensis</i>            |
| —                      | .. <i>A. Tamurai</i>              |
| —                      | .. <i>A. Aleyrodis</i>            |
| —                      | .. <i>A. hypocreoidea</i>         |
| —                      | .. <i>A. Goldiana</i>             |
| —                      | .. <i>A. australiensis</i>        |
| <i>H. Andropogonis</i> | .. <i>A. Andropogonis</i>         |
| <i>H. Sloaneæ</i>      | .. (Not named)                    |
| <i>H. Raciborskii</i>  | .. <i>Aschersonia placenta</i>    |

In the *Lecaniicolæ* the first seven species are usually subglobose and even, though in *H. palmæ*, *H. caulium*, and *H. olivacea* the stroma is sometimes scutate or flattened pulvinate. *H. scutata*, *convexa*, and *bispora* are flattened pulvinate or discoid. *H. verruculosa* and the six following species are tuberculate. *H. turbinata* bears pezizoid discs, at least in its *Aschersonia* stage; *H. phyllogena*, in its typical form, is stud-shaped; and *H. oxystoma* is columnar in its *Aschersonia* stage.

Of the *Aleyrodiicolæ*, *H. discoidea*, *H. viridans*, and *H. palmicola* are typically discoid; their *Aschersonia* stages have regular, more or less globose pycnidia. *A. badia*, *A. brunnea*, *A. flava*, *A. crenulata*, and *A. blumenaviensis* have similar pycnidia, the first four having discoid stromata, while that of the last is somewhat stud-shaped. *H. Mollii* has a flattened pulvinate stroma, sometimes tuberculate, and its pycnidia are regularly oval. *H. duplex* has either simple pulvinate, or compound tuberculate stromata, with regular globose pycnidia. In *H. tubulata*, *A. columnifera*, and *A. acutispora*, the stroma usually bears projecting cylindrical processes. *A. taitensis* and *A. Tamurai* are discoid, the latter tending to flattened pulvinate; their pycnidia have definite ostiola, but are irregular towards the base. The remaining species have flattened pulvinate stromata, with widely-open, irregular pycnidia.

## KEY TO THE KNOWN SPECIES.

*Aschersonia*.

## I.—No paraphyses in the pycnidium :—

A.—Pycnosporos fusoid or narrow-oval, ends not produced :—

- |                                            |    |                       |
|--------------------------------------------|----|-----------------------|
| (1) Pycnosporos, 13-18 × 4-5 μ             | .. | <i>H. cavernosa</i>   |
| (2) Pycnosporos, 9-14 × 2-3.5 μ            | .. | <i>A. Coffeæ</i>      |
| (3) Pycnosporos, 6-13 × 1-2 μ :—           |    |                       |
| (a) Stroma minutely verrucose, olive brown | .. | <i>H. olivacea</i>    |
| (b) Stroma minutely verrucose, red-brown   | .. | <i>H. pelmæ</i>       |
| (c) Stroma smooth, fuscous                 | .. | <i>A. marginata</i>   |
| (d) Stroma smooth, scarlet                 | .. | <i>H. ceramichroa</i> |

B.—Pycnosporos with prolonged tips :—

- |                                                                               |    |                      |
|-------------------------------------------------------------------------------|----|----------------------|
| (1) Stroma columnar, pycnidial orifice ring-shaped                            | .. | <i>A. oxystoma</i>   |
| (2) Stroma pezizoid or columnar, pycnidium tubular, branching                 | .. | <i>A. turbinata</i>  |
| (3) Stroma stud-shaped, or flattened pulvinate, with a membranous hypothallus | .. | <i>A. basicystis</i> |
| (4) Stroma two-thirds globose, buff                                           | .. | <i>A. cubensis</i>   |

## II.—Paraphyses present in the pycnidium :—

A.—Stroma discoid : pycnidia regular, globose :—

- |                                                         |    |                          |
|---------------------------------------------------------|----|--------------------------|
| (1) Stroma red                                          | .. | <i>A. samoensis</i>      |
| (2) Stroma white, becoming green                        | .. | <i>A. viridans</i>       |
| (3) Stroma yellow :—                                    |    |                          |
| (a) Subrugose, opaque, scarcely constricted at the base | .. | <i>A. samoensis</i>      |
| (b) Smooth, opaque, constricted at the base             | .. | <i>A. blumenariensis</i> |
| (c) Smooth, subtranslucent                              | .. | <i>A. flava</i>          |

- (4) Stroma light brown, paraphyses up to 100  $\mu$  .. .. *A. badia*
- (5) Stroma purple-brown, paraphyses up to 160  $\mu$  :—
- (a) Spores 16–19  $\mu$  .. .. *A. brunnea*
- (b) Spores 10–14  $\mu$  .. .. *A. crenulata*
- B.—Stroma discoid, pycnidia irregularly oval .. .. *A. taitensis*
- C.—Stroma discoid, pycnidia flask-shaped *A. Tamurai*
- D.—Stroma pulvinate, pycnidia regular, spore masses distinct :—
- (1) Flattened pulvinate; pycnidia flask-shaped .. .. *A. confluens*
- (2) Subglobose; pycnidium globose, usually solitary .. .. *A. duplex*
- E.—Stroma cylindric, or pulvinate with cylindrical processes :—
- (1) Pycnosporos with prolonged tips .. *A. acutispora*
- (2) Pycnosporos fusoid :—
- (a) Pycnidia globose, with a long neck *H. tubulata*
- (b) Pycnidia cylindric .. .. *A. columnifera*
- F.—Stroma pulvinate, pycnidia irregular, spore masses distinct .. .. *A. Andropogonis*
- G.—Stroma pulvinate, pycnidia regular, spore masses confluent :—
- (1) Yellow or orange .. .. *A. Tamurai*
- (2) Grayish-yellow, translucent .. .. *A. australiensis*
- H.—Stroma pulvinate: pycnidia widely open, irregular, spore masses confluent :—
- (1) Spore mass reddish or orange-red :—
- (a) Paraphyses 40–80  $\mu$  .. .. *A. placenta*
- (b) Paraphyses 65–100  $\mu$  .. .. *A. Aleyrodis*
- (2) Spore mass yellow .. .. *A. Goldiana*

## I.—Stroma plane, thin, spore masses confluent :—

- (1) Pycnidia widely open, irregular .. *A. hypocreoides*  
 (2) No pycnidia, basidia on a central  
 disc .. .. *H. Sloaneæ*

K.—Pycnospores,  $4-6 \times 1.5 \mu$  .. *H. palmicola*

N.B.—Small specimens of *A. placenta* may have regular pycnidia, and resemble *A. Tamurai*, others may have thin stromata as in *A. hypocreoides*, from which they differ in the colour of the spore masses.

*Hypocrella.*

I.—Stroma pezizoid, simple or compound .. *H. turbinata*

## II.—Stroma discoid :—

- A.—Orange-red or yellow .. *H. discoidea*  
 B.—White, becoming green .. *H. viridans*

III.—Stroma stud-shaped .. *H. phyllogena*

## IV.—Stroma two-thirds globose :—

## A.—Minutely verrucose :—

- (1) Red-brown .. *H. palmæ*  
 (2) Greenish or olive-brown .. *H. olivacea*

## B.—Smooth :—

- (1) Stroma scarlet, perithecia scattered . *H. ceramichroa*  
 (2) Stroma scarlet, perithecia in an apical  
 area .. .. *H. caulium*  
 (3) Stroma yellow or buff, glabrous,  
 becoming fuscous .. *H. Reineckiana*  
 (4) Stroma buff, minutely pruinose .. *H. epiphylla*  
 (5) Stroma reddish-brown .. *H. cavernosa*

## V.—Stroma flattened pulvinate, or scutate :—

- A.—Irregularly pulvinate, white or pale  
 yellow .. *H. Mollii*  
 B.—Even, stroma resinous .. *H. scutata*



C.—Even, pale ochraceous .. *H. convexa*

D.—Scutate, scarlet, perithecia in an apical area .. *H. caulium*

E.—Scutate, purple-black .. *H. bispora*

F.—Minutely verrucose :—

(1) Chestnut-brown .. *H. palmicola*

(2) Olive-brown .. *H. olivacea*

VI.—Stroma tuberculate :—

A.—Tubercles pulvinate, stroma subglobose :—

(1) Stroma red .. *H. javanica*

(2) Stroma pale yellow, opaque, reddish at the base .. *H. duplex*

(3) Stroma pale yellow or whitish, opaque, unicolorous .. *H. tubulata*

(4) Stroma pale yellow or whitish, sub-translucent .. *H. oxystoma*

(5) Stroma yellow-brown .. *H. verruculosa*

B.—Tubercles developed at the margin of the pycnidial stroma :—

(1) Part-spores  $10-16 \times 2-3 \mu$  .. *H. Sloanæ*

(2) Part-spores  $8-12 \times 2-2.5 \mu$  .. *H. Raciborskii*

C.—Tubercles produced :—

(1) Stroma white or pale yellow, tubercles smooth :—

(a) Tubercles cylindric .. *H. Amomi*

(b) Tubercles inflated outwards .. *H. botryosa*

(2) Stroma pale yellow, tubercles verrucose .. *H. Gartneriana*

(3) Stroma reddish-purple .. *H. Schizostachyi*

(4) Stroma rosy-orange .. *H. nectrioides*

VII.—Stroma pulvinate, with irregular pycnidial cavities ; perithecia embedded in the stroma between the pycnidia .. *H. Andropogonis*

## LECANIICOLÆ.

*Hypocrella*, subgenus *Fleischeria*.

**Hypocrella palmæ** (Berk. & Curt.) Sacc., Syll. Fungorum, II., p. 580 (1883).—Hemispherical, or two-thirds globose, up to 6 mm. diameter, sometimes broadly convex, usually strongly ridged obliquely or horizontally, moderately hard; red-brown, becoming black when old; internally pallid or yellow, purplish towards the exterior in old specimens; surface usually even, sometimes convoluted, or irregularly lobed, rough with projecting ostiola, rarely almost smooth; perithecia usually arranged regularly round the periphery, flask-shaped, 0·3–0·4 mm. long, 0·2 mm. diameter; asci eight-spored,  $160 \times 8 \mu$ , part-spores cylindric with rounded ends,  $5-10 \times 1\cdot5-2 \mu$ . Pycnidia globose, 0·2 mm. diameter; pycnospores fusoid,  $9-13 \times 1-1\cdot5 \mu$ . *Hypocrea palmæ* B. & C., Jour. Acad. Nat. Sci. Philadelphia, New Ser., II., p. 285 (1853); *Hypocrella phyllogena* Speg., Fung. Arg., Pug. IV., No. 209; *Hypocrella Spegazzinii* Sacc., Syll. Fung., II., p. 579, ex Speg., Fung. Arg., Pug. IV.; *Hypocrella guaranitica* Speg., Fungi Guar., Pug. I., No. 256; *Hypocrella filicina* Rehm, Hedwigia (1898), p. 200; *Fleischeria paulensis* v. Höhnelt, Ergeb. der Bot. Exped. der K. Akad. d. Wissensch. nach Sud Brasilien, 1901, Bd. II., p. 21 (1907); *Hypocrella globosa* Syd. non Rac., Ann. Myc., V., p. 359 (1907); *Hypocrella orbicularis* Syd., in Theissen, Ann. Myc., IX., p. 67 (1911); *Hypocrella phyllophila* Theiss., Ann. Myc., IX., p. 66 (1911); *Hypocrella ambiens* Theiss., Ann. Myc., IX., p. 68 (1911); *Hypocrella Sydowii* Sacc. and Trott., Syll. Fungorum, XXII., p. 503 (1913).

This species has the peculiarity of possessing in the majority(?) of cases a well-defined ridge running horizontally or obliquely round the stroma at varying distances from the base, a feature which occurs to some extent in *Hypocrella olivacea* also. This is apparently caused by the elevation of the scale during the growth of the fungus, its final position being indicated by the ridge. Potash gives a yellow or greenish-yellow extract, but this sometimes fails with old specimens.

The type specimen in Herb. Kew is labelled "*Hypocrea palmæ*. *Tubercularia palmæ* Schwein. Surinam. Herb. Schwein."; it contains two specimens, 2 and 4 mm. in diameter respectively now detached from the leaf: they are now black, about two-thirds globose, and ridged obliquely: Berkeley gave the colour as red-brown; the surface is irregularly wrinkled or convoluted; internally the colour is purplish (after repeated preserving); the perithecia are arranged regularly round the periphery and the part-spores measure  $8-9 \times 2 \mu$ . The type specimen of *Hypocrella Spegazzinii* Sacc. is Spegazzini, Fungi Argentini Pugillus IV., No. 209, on *Coutarea mollis*, Brazil; a specimen furnished by Spegazzini is labelled "In foliis coriaceis, Apiahy, May '81. Puiggar"; this is the species listed by Spegazzini (*loc. cit.*) as *Hypocrella phyllogena* (Mont.) Speg., and the herbarium specimen bears that name. The stromata are up to 5 mm. diameter, broadly convex, up to 2 mm. thick in the centre, generally ridged a short distance from the lower margin; they are rough with projecting ostiola, red-brown towards the base, black or blackish-brown above; the perithecia are arranged either regularly round the periphery or at varying depths: in general the stromata are immature, but some contain part-spores  $5-8 \times 2 \mu$ . The type of *Hypocrella guaranitica* Speg. is Spegazzini, Fungi Guarantici, Pugillus I., No. 256, on living leaves of *Euphorbiaceæ*, near Villa Rica, Brazil; I have examined the type specimen from Herb. Spegazzini: it is represented in Herb. Kew, Herb. Paris, and Herb. Berlin by "B. Balansa. Pl. du Paraguay, 1878-1884. No. 3546. Feuilles d' Euphorbiaceæ. Santa Barbara, pres de Villa-Rica, Fevrier 1882," which are apparently co-types; the specimens are associated with a *Lecanium*: the Berlin specimens are smoother than those at Kew; they agree with Spegazzini's description, but are *Hypocrella palmæ*. The type specimen of *Hypocrella orbicularis* Syd. (= *Hypocrella globosa* Syd., name antedated) in Herb. Berlin, "Brazil. Prov. S. Paulo. Leg. F. Noack. Comm. P. Sydow" has part-spores  $6-10 \times 1.5-2 \mu$ ; old specimens are purplish internally near the periphery; the stromata vary in roughness, some being almost smooth; they are associated with a *Lecanium*: *Hypocrella Sydowii* Sacc. & Trott. is merely another re-naming of the same gathering. *Hypocrella filicina* Rehm, type specimen "E. Ule. Herbarium Brasilense, No. 857, on *Blechnum* sp. Estado de Sta. Catharina, Blumenau, July, 1888," in Herb. Berlin, is immature, but is evidently *H. palmæ*: the co-type in Herb. British Museum does not contain any fungus, except a slight covering on one *Lecanium*. *Hypocrella phyllophila* Theissen, type *ex* Herb. Theissen, on leaves of *Myrtaceæ*, Sao Leopoldo, Rio Grande do Sul, contains only small specimens which do not differ from *Hypocrella guaranitica*. *Hypocrella ambiens* Theiss., "G. Riek, 1906, Sao Leopolda, Brazil," *ex* Herb. Theissen, contains large black specimens, up to 10 mm. diameter, minutely roughened, the ostiola scarcely projecting; the perithecia are more crowded than usual in a well-defined cortical zone; the specimens have been hollowed out by some

insect. *Fleischeria paulensis* v. Höhnelt, on twigs of a *Melastomaceæ*, Sao Paulo, Cantareira, type *ex* Herb. v. Höhnelt, is quite indistinguishable from *H. ambiens*. Specimens from Venezuela *ex* Herb. Thaxter (Coll. A. F. Blakeslee) are bright brownish-red ; they are tuberculate towards the base.

Pycnidia have not been found in any of the specimens cited above. In a collection from Trinidad (*ex* Herb. Thaxter) some of the examples contain both pycnidia and perithecia, the former near the margin, and the latter in the centre ; the pycnidia are globose, 0.2 mm. diameter, and the pycnosporos are fusoid,  $9-13 \times 1-1.5 \mu$ . The specimens are circular, scutate, or flattened pulvinate, up to 4 mm. diameter, and 1 mm. thick in the centre ; most of them thin out to a margin about 0.1 mm. thick, but some are 0.7 mm. thick at the edge ; the colour is now black, but sections show a yellow-brown deposit beneath the black exterior. These are on a large flat *Lecanium*, and their shape is strikingly similar to that of *H. olivacea* under the same conditions. In Herb. Kew, *sub* *Aschersonia oxyspora*, there is a leaf bearing *Aschersonia turbinata*, collected by Spruce at San Carlos and recorded by Berkeley under the former name in Hooker's Journal of Botany and Kew Garden Miscellany, VIII. (1865), p. 278. Among these is a specimen which appears to be the *Aschersonia* stage of *H. palmæ*. It is black, semiglobose, slightly contracted at the base ; it is situated excentrically on the scale and consequently the base is expanded on one side ; the surface is minutely roughened ; internally it is now purplish-fuscous ; the pycnosporos are fusoid, ends not tapering,  $8-10 \times 2 \mu$ .

*Distribution*.—Surinam, type in Herb. Kew. Venezuela, in Herb. Thaxter. Brazil, *Hypocrella Spegazzinii* Sacc., in Herb. Spegazzini ; *Hypocrella guaranitica* Speg., in Herb. Spegazzini, Herb. Kew, Herb. Paris, and Herb. Berlin ; *Hypocrella orbicularis* Syd., in Herb. Berlin ; *Hypocrella flicina* Rehm. E. Ue 857, in Herb. Berlin ; *Hypocrella phyllophila* Theiss., in Herb. Theissen ; *Hypocrella ambiens* Theiss., in Herb. Theissen ; *Fleischeria paulensis* v. Höhnelt, in Herb. v. Höhnelt. Trinidad, in Herb. Thaxter.

*Figures*.—Plate 2, fig. 1, specimen *ex* type of *Hypocrella globosa* Syd., in Herb. Berlin,  $\times 6$  ; Plate 4, fig. 1, section of specimen *ex* type of *Fleischeria paulensis* v. Höhnelt,  $\times 3$  ; Plate 4, fig. 2, section of specimen *ex* type of *Hypocrella globosa* Syd.,  $\times 3$  ; Plate 5, fig. 54, perithecium,  $\times 100$  ; Plate 5, fig. 55, apex of ascus and spores,  $\times 600$  ; Plate 5, fig. 57, part-spores,  $\times 900$ .

***Hypocrella olivacea* Petch.**—Stromata two-thirds globose or conico-pulvinate, or flattened convex, up to 5 mm. diameter and 3 mm. high, sometimes ridged horizontally or obliquely near the base, minutely verrucose ; moderately hard ; at first greenish-yellow, then olive-brown, or dark rufous brown, finally blackening ; internally pale yellow or white, with a brown zone at the periphery. Ostiola scattered, projecting.

Perithecia flask-shaped, with a long neck, up to 0.5 mm. deep, 0.2–0.25 mm. diameter; asci 120–140  $\times$  8–9  $\mu$ ; part-spores cylindric, becoming oblong-oval, 5–8  $\times$  1.5–2  $\mu$ . Pycnidia flask-shaped or oval, 0.25 mm. deep, 0.2 mm. diameter, immersed, or with the apex in a projecting point; pycnosporos fusoid, sharply pointed, 8–11  $\times$  1.5  $\mu$ . *Fleischeria sclerotioides* v. Höhnelt, *Fragmente zur Mykologie*, VIII. Mitt., p. 26 (1909); *Hypocrella scutata* Auctt., non Cooke.

This species occurs in two well-defined forms, according to the type of *Lecanium* on which it is growing. On pulvinate scales, such as *Lecanium nigrum*, it takes the two-thirds globose or conico-pulvinate form of *H. Reineckiana*, from which it is distinguished by its colour and minutely verrucose surface. But on large flat scales it may be scutate, only slightly elevated in the centre. This latter form appears to have been generally recorded under the name of *Hypocrella scutata*, e.g., by Penzig and Saccardo, *Icones Fungorum Javanicorum*, judging from their figure. The brown internal zone appears to be well-developed only when the perithecia are formed. Pycnidia and perithecia occur commonly in the same stroma. It gives a yellow or yellow-brown extract with potash. It resembles *Hypocrella palmæ*, in that the scale is frequently lifted off the leaf by the growth of the fungus, its position being subsequently indicated by a ridge round the stroma; on the scutate stromata this sometimes results in the production of a definite vertical margin, about 0.5 mm. high.

This species has been well described by von Höhnelt under the name of *Fleischeria sclerotioides*, from specimens on a scale insect on *Ficus*, Tjibodas, Java, the name being based on the supposition that it was the ascigerous stage of *Aschersonia sclerotioides*. But from specimens kindly lent me by Prof. von Höhnelt, it is clear that these are identical with the present species, which is not connected with *Aschersonia sclerotioides*.

In Herb. Berlin specimens of the *Aschersonia* stage on *Morus indica* and *Mimosa sensitiva*, from Amani, and on *Acacia Lebbeck* from Ngamba, are included under *Aschersonia sclerotioides*. It is common in Ceylon in the neighbourhood of Hakgala (5,600 feet) on *Lecanium oleæ* on *Allophylus zeylanicus*, in company with *Hypocrella javanica* and *Hypocrella Reineckiana*; it has also been found on *Paralecanium calophylli* on *Myristica*, Hakgala, and on the same insect on *Eugenia* sp., Namunukuli.

In my preliminary paper this species was referred to as *Hypocrella marginata*, on the supposition that its *Aschersonia* stage was identical with *Aschersonia marginata* E. & E. A re-examination of the specimens has, however, shown that *Aschersonia marginata* is identical with *Aschersonia sclerotioides*, and is consequently the *Aschersonia* stage of *Hypocrella Reineckiana*.

*Distribution*.—Java, Herb. von Höhnelt. East Africa, Herb. Berlin. Ceylon, Herb. Peradeniya.



*Figures*.—Plate 2, fig. 2, flattened form, Ceylon,  $\times 5$ ; Plate 2, fig. 3, subglobose form, Ceylon,  $\times 5$ ; Plate 4, fig. 24, section, Ceylon,  $\times 3$ ; Plate 4, fig. 25, section, Ceylon,  $\times 4$ ; Plate 4, fig. 26, section, Ceylon,  $\times 4$ ; Plate 5, fig. 62, pycnospores,  $\times 1000$ .

*Hypocrella epiphylla* (Masse) Sacc., *Sylloge Fungorum*, XI., p. 368 (1895).—Pycnidial stroma 1–4 mm. diameter; in small specimens hemispherical, or subconoid, or subcylindric, with a single depressed pycnidial orifice at the apex, usually filled with a red-brown mass of spores, upper edge of stroma rounded; in large specimens, two-thirds globose with up to a dozen scattered, sunk, pycnidial orifices; white or buff, or reddish-brown, internally white or yellowish; minutely pruinose. Pycnidium in the small stromata globose, sometimes widely open, even or convoluted; in the larger stromata, irregular, expanded and flattened parallel to the surface, or tubular and branching; pycnospores fusoid, ends tapering and sharply pointed,  $10-14 \times 3-4 \mu$ . Perithecial stromata sub-hemispherical or two-thirds globose, even or sub-tuberculate, buff or reddish-brown, up to 2 mm. diameter; ostiola red-brown, not projecting; no hypothallus; perithecia flask-shaped with a long neck, 0.4–0.6 mm. deep, 0.2 mm. diameter, scattered; part-spores cylindric or oval,  $8-12 \times 4 \mu$ . *Hypocrea* (*Clin-toniella*) *epiphylla* Mass., *Jour. of Botany*, 1892, p. 164, t. 333, figs. 27–30. *Aschersonia* stage—*Aschersonia cubensis* Berk. & Curt., *Jour. Linn. Soc.*, X., p. 351 (1869); *Aschersonia amazonica* P. Henn., *Hedwigia* (1904), p. 338; *Aschersonia consociata* P. Henn., *Hedwigia* (1904), p. 338.

The type specimen of *Hypocrea epiphylla* Mass. was collected on leaves of *Dieffenbachia*, Morne Cochon, St. Vincent, by W. R. Elliott. Massee stated that it is “tomento albo basi circumdata”; some of the specimens show that feature, but it is due to a mould which spreads over the fungus and the leaf in a circular patch up to 5 mm. diameter. The specimens examined contained immature pycnidia as well as perithecia, and from the original description, which gives the spores as  $50-55 \times 1.5 \mu$ , it is evident that mature ascospores were not seen. In a collection of *Aschersonia cubensis* from Trinidad, ex Herb. Thaxter, one specimen is perithecial; it is reddish-brown, slightly tuberculate; the perithecia contain loose spores, which are apparently part-spores some of which have germinated and partly filled the cavity with hyphæ; the part-spores are cylindric with rounded ends, or narrow-oval, and measure  $8-12 \times 4 \mu$ . It is probable that *Hypocrella verruculosa* is identical with *H. epiphylla*, but no

specimens of the latter have been found so tuberculate as that figured by Möller for the former species.

Though *Hypocrella epiphylla* is rare, its *Aschersonia* stage, *A. cubensis*, appears to be common in the Western tropics. The type specimen in Herb. Kew, on *Pteris*, Cuba, contains small stromata, generally with one pycnidium, but in some cases two; Herb. Paris contains part of the same gathering (Curtis 427). *Aschersonia amazonica* P. Henn., type in Herb. Berlin, on leaves and stems of *Bignoniaceæ*, Iquitos (Ule 3208) contains small specimens, 1.5 mm. diameter, with one pycnidium, and others 4 mm. diameter with up to a dozen; it is on a *Lecanium*. Under the same name, in Herb. Berlin, is another gathering on *Psychotria*, Rio Negro, Manaos; most of these specimens have a single pycnidium, it is on *Lecanium hemisphericum*. *Aschersonia consociata* P. Henn., type in Herb. Berlin, on *Davilla*, Brazil (Ule 2889), contains a single specimen of *A. cubensis* with numerous pycnidia. C. F. Baker, 222 b, on *Cordia umbraculifera*, Para, Brazil, sub *Aschersonia sclerotoides* in Herb. Berlin, is *A. cubensis*.

Specimens of this species have been sent me by H. S. Fawcett, on *Lecanium* (? *hesperidum*) on *Persca carolinensis* Florida; and by F. W. South, on *Lecanium* (? *mangiferae*) on Guaya, mixed with *A. turbinata*, Trinidad. From Prof. Thaxter, I have received specimens from Grenada, Florida, and Trinidad.

Small subcylindrical specimens of the *Aschersonia* may be confused with small specimens of *Aschersonia turbinata*, but they may be distinguished by the rounded upper edge of the stroma and the shape of the pycnosporos. Large specimens resemble *Hypocrella cavernosa* in structure, but differ in the smaller spores with more tapering points, and the sunken pycnidial orifices. Potash stains a section purple here and there in isolated patches.

*Distribution*.—St. Vincent (*H. epiphylla*), in Herb. British Museum. Florida, in Herb. Peradeniya, and Herb. Thaxter. Grenada, in Herb. Thaxter. Trinidad, in Herb. Thaxter. Cuba (*Aschersonia cubensis*), in Herb. Kew and Herb. Paris. Brazil, in Herb. Berlin (*A. consociata* and sub *A. sclerotoides*). Peru, in Herb. Berlin (*A. amazonica*).

*Figures*.—Plate 3, fig. 24, *Aschersonia cubensis*, Florida specimen,  $\times 6$ ; Plate 3, fig. 28, specimen *ex* type,  $\times 8$ ; Plate 4, fig. 9, section of *Hypocrella*,  $\times 6$ ; Plate 4, fig. 31, section, *Aschersonia cubensis*, simple form,  $\times 6$ ; Plate 4, fig. 32, section, *Aschersonia cubensis*, compound form,  $\times 3$ .

***Hypocrella Reineckiana*** P. Henn., Engler's Bot. Jahrbuch, XXIII., p. 286 (1896).—Hemispherical, or two-thirds globose, or conico-pulvinate, up to 4 mm. diameter; moderately hard; at first pale yellow, or buff, becoming fuscous or slate-coloured with a glaucous bloom, finally black; internally pale yellow or whitish; usually smooth, glabrous, even, sometimes furrowed or convoluted. Pycnidia scattered, orifices yellow-brown or red-brown, usually sunk, flask-shaped or lobed, on

tubular, sometimes extending to the middle of the stroma ; pycnosporos fusoid, ends pointed,  $6-10 \times 1.5-2 \mu$ . Perithecia scattered, flask-shaped, ostiola rarely projecting, up to 0.3 mm. deep, 0.15 mm. diameter, colour as the pycnidial orifices ; asci  $170-180 \times 8 \mu$ , eight-spored ; part-spores cylindric,  $6-8 \times 1-1.5 \mu$ . *Hypocrella Pernettyæ* Pat., Ann. Bot. Jardin Buitenzorg, 1st Supplement, p. 125 (1897) ; non *Fleischeria sclerotioides* v. Höhnelt, Fragmente zur Mykologie, VIII. Mitt., p. 26 (1909) ; *Hypocrella melaena* Syd., Philippine Jour. of Sci., VIII. C, p. 494. *Aschersonia* stage—*Aschersonia marginata* E. & E., Bull. Torrey Bot. Club (1895), p. 436 ; *Aschersonia sclerotioides* P. Henn., Hedwigia (1902), p. 146 ; *Aschersonia pisiformis* Pat., Bull. Soc. Myc. France, XXII., p. 59 (1906).

This is the common species on *Lecanium* in Ceylon, and apparently in the Eastern tropics generally. It resembles *Hypocrella cavernosa* Möll. in its tubular pycnidia, but this feature is not constant. The *Hypocrella* stromata, as a rule, contain pycnidia also, but the species is most frequently found in the *Aschersonia* stage, *i.e.*, with pycnidia only.

In the type of *H. Reineckiana* in Herb. Berlin, on petioles, stems, and leaves of some climbing *Rhaphidophora*, Upolu, the stromata are ochraceous, closely dotted with brown perithecial ostiola, which do not project : they are about 2 mm. diameter, not 3 centimetres as stated by Hennings ; the perithecia are arranged regularly round the periphery (in section), and are 0.25–0.3 mm. deep. and 0.12–0.15 mm. diameter ; the part-spores, in the ascus, measure  $6-8 \times 1 \mu$  ; the stromata also contain pycnidia, 0.2 mm. diameter and 0.3 mm. deep, lobed below ; the pycnosporos are not quite mature and measure  $6-10 \times 0.75-1 \mu$ . In *Hypocrella Pernettyæ*, on leaves of *Pernettya repens*, Java, type *ex* Herb. Patouillard, the specimens are now clay-coloured ; they are smooth and subglobose but some have been eaten away at the top by insects ; the stromata contain pycnidia as well as perithecia ; they are associated with a *Lecanium*.

*Aschersonia marginata* is represented in Herb. Kew, Herb. British Museum, and Herb. Berlin by parts of the type collection, "Plants of the Hawaiian Islands, collected on the Island of Oahu, in and on the slopes of Makiki. On *Psidium Guayanae*, 1945." These are on a *Lecanium*. In all the collections the specimens are old and black ; the pycnidial orifices are scattered, most of them near the base, with the edge recurved and lacerated, as is usual in old specimens ; the stromata are only "margined" when they are situated eccentrically on the scale, so that the latter projects on one side. The potash extract is brownish-yellow. The pycnidia are oval or tubular, some of the latter penetrating almost to the base of the stroma. The pycnosporos measure  $7-10 \times 1.5 \mu$  ;

but in some pycnidia they are only  $5 \times 1.5 \mu$ ; this reduction in size is probably to be associated with the age of the stroma. *Aschersonia sclerotoides* P. Henn., on *Castilleja elastica*, Java, type in Herb. Berlin, is associated with *Lecanium oleæ*; the stromata are two-thirds globose, smooth, vertically furrowed towards the base, up to 3 mm. in diameter and 2.5 mm. high, slate-coloured, with numerous pycnidia situated near the base; the pycnosporos are narrow-oval,  $6-8 \times 1.5-1.75 \mu$ ; none of the other gatherings under this name in Herb. Berlin are this species; the specimens from East Africa, on *Morus indica* and *Mimosa sensitiva*, Amani, and on *Acacia Lebbeck*, Ngamba, are the *Aschersonia* stage of *Hypocrella olivacea*. Puttemans 788, included under *A. sclerotoides* in Herb. Berlin, is *Hypocrella cavernosa*, while "C. F. Baker, 222 b, Para, Brazil," in the same cover in Herb. Berlin is *Aschersonia cubensis*. *Aschersonia pisiformis* Pat., "sur des coccides parasites des feuilles de cocotier, Tahiti. Leg. Seurat," is represented in Herb. Paris and Herb. Patouillard; it is on a *Lecanium*; the specimens are blackened, but from one example they were apparently clay-coloured or buff when young; the stromata in some cases do not completely enclose the scale, but leave a margin which is only slightly covered by the fungus; hence the "infernæ marginato" of the original description, which is an accidental feature; some of the stromata are rough.

Specimens in Herb. Peradeniya include the following:—On *Lecanium marsupiale*, Ceylon, and C. A. Barber No. 974, India; on *Lecanium oleæ* on *Allophylus zeylanicus*, Ceylon; on *Lecanium nigrum* on *Hevea*, Ceylon (several collections); on *Lecanium* sp. on *Amomum*, Ceylon; on *Calophyllum Walkeri* (Parkin, pp. 39, 40); on *Lecanium tessellatum* on *Litsea zeylanica*; on *Citrus*; on *Lecanium* sp. on *Garcinia*; on *Lecanium* on *Gelonium lanceolatum* (Parkin's species, p. 40); on *Lecanium* on *Tabernæmontana*; on *Lecanium* on Nutmeg; on *Lecanium hemisphæricum* on *Jacquinia aristata*; on *Lecanium psidii* on Nutmeg (Parkin B. 1, p. 39); on *Lecanium* on *Samadera indica*; on *Lecanium* on *Loranthus*.

*Hypocrella melæna* Syd., co-type ex Bureau of Science, Manila, examined, contains old, black specimens, flatter than usual; they yield a yellow-brown extract with potash, but are too smooth for *H. olivacea*, to which one might be inclined, in the present state of the specimens, to refer them.

Specimens from Japan and Formosa recorded by Miyabe and Sawada as *Aschersonia marginata* are this species. One collection on *Psidium Guayava*, Giran, Formosa, Feb. 29, 1908, was said to be on *Parlatoria zizyphi* Lucas, but there is also a *Lecanium* present. Another collection, on *Citrus nobilis*, Kagoshima, Kiusiu, Japan, May, 1903, is also said to be on *Parlatoria*.

The colour with potash is variable; some specimens are tinged purple, others are not coloured. In old specimens the stroma may turn yellow-brown round the perithecia and yield a yellow-brown extract. In one gathering none of the stromata yield any extract with potash, except one old specimen, over-run with *Meliola*, which gives a vivid violet colour. In a large number of Ceylon gatherings the hyphæ are filled with a deep yellow plasma,



but these do not differ in other respects from stromata in which the contents of the hyphæ are colourless; the former, which are the more highly coloured internally, give no colour with potash.

The glaucous "bloom" on the surface of the young stroma is due, as remarked by Parkin, to the development of a surface layer of scattered conidiophores and conidia; the conidiophores are about  $12\mu$  long, and the conidia smaller ( $5-8 \times 1-1.5\mu$ ) than those in the normal pycnidia.

*Distribution*.—Ceylon, in Herb. Peradeniya. India, in Herb. Peradeniya. Java, in Herb. Patouillard (*H. Pernettyæ*); in Herb. Berlin (*A. sclerotoides*). Sandwich Islands (*Aschersonia marginata*) in Herb. Kew, Herb. British Museum, and Herb. Berlin. Tahiti, in Herb. Paris and Herb. Patouillard (*A. pisiformis*). Solomon Islands, in Herb. Peradeniya. Upolu, in Herb. Berlin (*H. Reineckiana*). Philippines (*H. melæna* Syd.), in Herb. Peradeniya. Formosa and Japan, in Herb. Sapporo (*sub A. marginata* E. & E.) Madagascar, on *Lecanium coffeæ*, in Herb. Peradeniya (Coll. d' Emmerez de Charmoy).

*Figures*.—Plate 2, fig. 14, Ceylon specimen, damaged on one side and showing the internal colour of the stroma,  $\times 6$ ; Plate 2, fig. 15, *Aschersonia*, young, with superficial conidia, Ceylon,  $\times 6$ ; Plate 2, fig. 23, old *Aschersonia*, blackened externally, partly in section and showing tubular pycnidia, Ceylon,  $\times 4$ ; Plate 4, fig. 10, section showing perithecia and tubular pycnidia,  $\times 3$ ; Plate 4, fig. 11, section, showing perithecia,  $\times 6$ .

*Hypocrella caulium* (B. & C.) Pat., Bull. Soc. Myc. France, XXX. (1914), p. 346. Stromata two-thirds or three-fourths globose, sometimes subturbinate, often confluent, up to 5 mm. diameter, hard; brick-red, scarlet, or cinnabar below, dark red, surrounded by a paler yellowish-white border, at the apex; pulverulent below; internally yellowish. Perithecia situated in the upper dark red area, crowded, oval, 0.3 mm. deep, 0.1 mm. diameter, neck long or short, ostiola not projecting; asci  $180-250 \times 3.5-4.5\mu$  (Hennings); part-spores immature,  $12-15 \times 0.3\mu$  (Hennings). Var. *brasiliiana* Hennings, Hedwigia, XLIII., p. 85. Stromata scutate, up to 1 cm. diameter, circular, the central portion evenly convex or nodular, about 3 mm. diameter and 2 mm. thick, rapidly thinning into the broad flatter margin; margin fimbriate; brick-red, orange-red, or pinkish-red, central boss ochraceous at the apex and cracked; internally dingy yellow, with a red peripheral zone about 0.25 mm. deep; substance rather soft. Perithecia crowded, in the apical ochraceous area; asci,  $170-250 \times 4-7\mu$ , eight-spored (Hennings). *Corticium*



*caulium* B. & C., Jour. Acad. Sci., II. (1853), p. 279. *Hypocrella camerunensis* P. Henn., Engler's Bot. Jahrb., XXIII., p. 540 (1897).

This, though a large species, appears to be usually found on twigs 4-6 mm. in diameter, and therefore almost completely surrounds them. In some cases adjacent stromata are fused into a continuous mass surrounding the twig, while in others the specimens consist only of a thin, barren stroma. The type specimen from Lolodorf (Staudt No. 214, April 14, 1895), on stems of some climber, in Herb. Berlin, consists of stromata of the normal lecaniicolous type, or rather more globose than usual; some of the stromata are fused together, in one case into a tuberculate mass 1.75 cm. long, and 7.5 mm. broad, bearing isolated, dark red, light-bordered areas which contain the perithecia. The perithecia are situated at two different depths, *i.e.*, more or less in two layers: those of the lower layer have correspondingly longer necks. These specimens are associated with *Stictococcus Sjostedti* Ckll. Another specimen in Herb. Berlin, from Bipindi, Cameroons, is encrusting, glabrous, thin, of uniform thickness, and sterile. Another collection from Lolodorf (Staudt, 23.3.95) contains scutate specimens, like var. *brasiliiana* in form, but glabrous. The specimens examined by me were immature. With potash, the exterior turns purple, but the interior does not colour. Var. *brasiliiana* is represented in Herb. Berlin and Herb. Kew by parts of the type collection, Ule 2613, on stems of *Eupatorium* sp., Rio de Janeiro. The Kew specimens are apparently barren. Ule 3036, on *Strychnos*, Rio Negro, in Herb. Berlin, contains sterile, slightly scutate specimens, which are glabrous. Puttemans 708, San Paulo, on a Composite, resembles Ule 2613; the surface is powdery, but the centre is still brick-red; the ochraceous centre of the more mature specimens appears to be due to the breaking up of the surface of the stroma, and consequent exposure of the internal tissue, on the development of the perithecia. A specimen from Costa Rica, in Herb. Berlin, matches Puttemans 708. There are also two collections on *Vismia*, from Para., in Herb. Berlin; one of these, collected by Dr. Huber, is glabrous, encrusting, and effused, like the Bipindi specimen; the other, collected by C. F. Baker, is encrusting, circular, scutate, and glabrous; both collections are sterile.

Some of the sterile forms resemble a coating of scarlet sealing wax on the stem: they have the normal *Hypocrella* hyphæ, and give the same reactions with potash as the fertile forms of *H. camerunensis*. There does not seem to be any reason to doubt their relationship. Patouillard has recently discovered (Bull. Soc. Myc. France, XXX., p. 346) that this sterile stroma was described as *Corticium caulium* Berk. & Curt. from specimens from Surinam. The species therefore becomes *Hypocrella caulium* (B. & C.) Pat., at least as far as the American form is concerned. It is probable that when riper material and the *Aschersonia* stages are available, the American and African species will be found to be distinct.

In Herb. Montagne there is a collection from Guiana, *Aschersonia guianensis* Mont. (Ann. Sci. Nat., Ser. 3, vol. II., p. 122), which probably represents the *Aschersonia* stage of this species. It is labelled, on the exterior of the envelope, "*Aschersonia guyanensis* Montg., ad folia. Guiana. Leprieur," while inside is the inscription, "*Sphaeria* ? floccis luteis contextis intricatis, conidiis minutissimis inspersis. Sporidiis non investigatis. Ad folia. D. Leprieur." There are two specimens of the *Aschersonia*, with a large *Lecanium* on the same leaf. They are brick-red, yellow within, conico-convex, or convex, apex flattened, up to 4 mm. diameter and 1.5 mm. high. The ostiola are in general arranged more or less regularly round the stroma on the sloping face, towards the margin; they are oval, very large, and vertically elongated; some, however, are situated on the flattened apex of one specimen. The specimens appear to be sterile. Montagne stated that he had not been able to find the spores.

*Distribution*.—(Type)—Cameroons, Lolodori, and Bipindi, in Herb. Berlin. Var. *brasiliانا*—Brazil, Ule 2613 in Herb. Berlin and Herb. Kew; Ule 3036, Puttemans 708, Dr. Huber on *Vismia*, Para, Baker on *Vismia*, Para, in Herb. Berlin. Costa Rica in Herb. Berlin. Surinam in Herb. Kew (*Corticium caulium*). ? Guiana in Herb. Montagne.

*Figures*.—Plate 2, fig. 10, ex type of *Hypocrella camerunensis*,  $\times 5$ ; Plate 2, fig. 13, ex var. *brasiliانا*,  $\times 2$ ; Plate 4, fig. 12, *Hypocrella camerunensis*, section,  $\times 3$ ; Plate 4, fig. 13, var. *brasiliانا*, section,  $\times 4$ .

***Hypocrella ceramichroa*** (B. & Br.) Petch.—Stromata 1.5–10 mm. diameter, and up to 5 mm. high, two-thirds globose, or hemispherical, or conico-pulvinate with an expanded base, smooth, or, in large specimens, irregularly furrowed; hard; scarlet, dotted with slightly projecting black or dark ostiola, internally yellowish with a red peripheral zone; glabrous. Perithecia scattered, flask-shaped with a long neck, up to 0.6 mm. deep and 0.25 mm. diameter; asci 170–180  $\times$  8  $\mu$ ; part-spores narrow-oval, ends obtuse, 6–8  $\times$  1.5–2  $\mu$ . Pycnidia scattered, cylindric or oval; pycnosporos narrow-oval, ends pointed but not tapering, 6–8  $\times$  2  $\mu$ . *Hypoxylon ceramichroum* B. & Br., Jour. Linn. Soc., XIV., p. 120 (1873); *Glaziella ceramichroa* (B. & Br.) Cooke, Grevillea, XI., p. 83 (1883); *Hypocrella ceramichroa* (B. & Br.) Petch (in part), Ann. Perad., IV., pp. 427–431.

Part of the type specimen of this species (Thwaites 1092) is in Herb. Kew, and the remainder in Herb. Peradeniya. It was collected on a *Lecanium* on the stem of a *Smilax* at Peradeniya. The majority of the specimens are immature; the stromata are hemispherical or two-thirds globose, smooth, irregularly furrowed

in the case of the largest; they are now deep red-brown, but, according to Berkeley and Broome, were originally scarlet. A second gathering of this species has been made on *Lecanium expansum* on *Schumacheria alnifolia*, Maskeliya, Ceylon (Parkin, *Hypocrella* No. 1, p. 29); these are conico-pulvinate with an expanded base, scarlet, dotted with black ostiola; they contain both perithecia and pycnidia. Parkin noted that the colour varied, the rim being nearer red and the crown nearer yellow; that would bring the species into line with *H. caulium*, but it is evident that that description was based on a specimen in which the crown had been damaged and the internal tissue exposed. Potash gives a purple extract.

The description of *H. ceramichroa* in Ann. Perad., IV., pp. 427-431, includes, in error, several details which relate to *Hypocrella Reineckiana*.

*Distribution*.—Ceylon, in Herb. Kew and Herb. Peradeniya.

*Figures*.—Plate 2, fig. 12, Ceylon specimen,  $\times 4$ ; Plate 4, fig. 27, section of type specimen, Ceylon,  $\times 3$ ; Plate 4, fig. 28, section, Ceylon specimen,  $\times 3$ .

***Hypocrella cavernosa* Möller**, *Phycomyceten und Ascomyceten* (1901), p. 299.—Stroma globose, smooth, light reddish-brown, hard, internally white, about 1 cm. diameter. Pycnidia tubular, branching, labyrinthiform below; conidia elongated fusiform,  $20 \times 6 \mu$ , hyaline, reddish in mass. Perithecia scattered, deeply sunk, elongated flask-shaped,  $425 \mu$  deep,  $125 \mu$  diameter, neck  $200 \mu$  long. Ascus  $170 \mu$  long. Part-spores oval,  $10-12 \times 4 \mu$ .

The above description is from Möller, *loc. cit.* The type specimen, which I have not seen, is said to be included in the spirit collection in Herb. Berlin. In a slide kindly lent me by Prof. Möller, the pycnidia appear circular, oval, or with convoluted outline in section; the pycnospores measure  $13-18 \times 4-5 \mu$ , exceptionally  $12 \times 6 \mu$ ; there are also immature, vacuolated conidia,  $12 \times 2-2.5 \mu$ . The part-spores are cylindric with rounded ends, becoming oval with truncate ends,  $8-14 \times 3.5 \mu$ ; immature cylindric spores may measure only  $7 \times 3 \mu$ .

This species is remarkable for the large size of its pycnospores. It has not been recorded again, and it is not represented by any other gathering under this name in any herbarium. But several collections of, apparently, this species have been included under *Aschersonia marginata*, &c. "E. Ule. Herbarium Brasiliense. 2627" is included under *Aschersonia marginata* in Herb. Kew and Herb. Berlin; the stromata are smooth, hard, black, covered with a greenish-yellow "bloom," which apparently consists of the conidiophores of an *Aspergillus*; the pycnidia are irregular, and the conidia measure  $10-16 \times 2-2.5$ ; the internal structure is that of *H. cavernosa*, and similar spores occur on Möller's slide. "Ule, Serra do Ouro Peto, 1892," *sub A. marginata* in Herb.

Berlin, has stromata two-thirds globose, up to 3 mm. diameter, hard, smooth, red-brown becoming black; it is unripe, but shows tubular or irregular pycnidia penetrating to the middle; it appears to be immature *H. cavernosa*. "Puttemans, 788, on dead branches, Serra da Cantareira," sub *Aschersonia sclerotoides* in Herb. Berlin, has stromata similar to Ule 2627 and contains immature asci.

A collection made by Thaxter in Trinidad consists of the *Aschersonia* stage only. Some of the specimens are small, flattened pulvinate, irregular, and somewhat effete. The larger specimens are subhemispherical, 3 mm. diameter, even or convoluted. They are now grayish-white, becoming purple-black; white internally. The pycnidial orifices are blackish, becoming lacerated when old. The pycnidia are tubular, either short, about 0.4 mm. deep, simple or convoluted at the base, or penetrating deeper and appearing as circular or oval cavities in section. The pycnospores are smaller than in the type and measure  $10-14 \times 4-5 \mu$ .

In Herb. Berlin there is a specimen, sub *Hypocrella luteo-olivacea* Winter, labelled "Brasília: Prov. Sao. Paulo; auf *Myrtaceæ* sp. Leg. F. Noack. Comm. P. Sydow." The stromata match those from Trinidad, but are perithecial. They are subglobose, convoluted, up to 3 mm. diameter, dirty white, with brown ostiola, which do not project; they are hard, and white internally. The perithecia are flask-shaped, up to 0.45 mm. deep and 0.15 mm. diameter; the wall of the perithecium is yellow. The part-spores are oval,  $9-12 \times 3-4 \mu$ . This appears to be the *Hypocrella* form of *H. cavernosa*.

*Distribution*.—Brazil, in Herb. Kew and Herb. Berlin. Trinidad, in Herb. Thaxter.

*Figures*.—Plate 2, fig. 4, *Aschersonia* stage, viewed from above, Trinidad specimen,  $\times 6$ ; Plate 4, fig. 14, section, after Möller,  $\times 1\frac{1}{2}$ .

***Hypocrella scutata*** (Cooke) Sacc., *Michelia*, I., p. 580 (1878).—Circular, up to 1 cm. diameter, flattened convex, up to 2 mm. thick in the centre, margin acute or obtuse, surface even, glabrous, pale-brown, dotted with red-brown ostiola, or dark brown in herbarium specimens; colour "bright ochraceous orange" when fresh; substance resinous, fracture vitreous; hypothallus when present, membranous, translucent; lower surface flat, translucent yellow-brown, marked with a central, yellowish, opaque spot from which radiate numerous, frequently anastomosing, yellow lines. Perithecia rather deeply sunk, flask-shaped or laterally compressed, up to 0.8 mm. deep; asci.  $400-500 \times 8-10 \mu$ , cylindric, eight-spored; part-spores cylindric with rounded ends,  $3-6 \times 1.5 \mu$ . *Hypocrea scutata* Cooke, *Grevillea*, VII., p. 14 (1878).

The type specimen of this extraordinary species was collected on *Myristica* at Singapore by Dr. J. Bancroft. A note on the type specimen reads "Substance melts by heat like lac; supposed to be the result of bite of coccus, as a black fungus covers the tree J. Bancroft of Brisbane, Australia, January, 1878." The type is now at Kew, where there is another specimen from Singapore, collected by Ridley, June 26, 1908. I have also a specimen from the Philippines, on *Dillenia philippinensis* Rolfe, Mt. Marquiling, Province of Laguna, Luzon, No. 7149, E. D. Merrill, September, 1910, kindly sent by Dr. Merrill. It has been recorded for Ceylon by Cesati, collected by Beccari, and for Java by Penzig and Saccardo, but both these records more probably relate to the flat form of *Hypocrella olivacea*. I have searched for it on *Myristica* in Ceylon without any success.

Cooke's figure in *Grevillea* erroneously shows the stroma turned up at the margin; in all the available specimens the base is quite flat and closely applied to the leaf. The stroma is subtranslucent and breaks with a vitreous fracture. It is evidently composed chiefly of resin, and if a section is placed in alcohol large quantities of resin are dissolved out. The first observer of it noted that it melted like lac. The fungus element of the stroma is a spongy mass, and consists of numerous "pockets," which are filled with resin. The reticulated pattern seen on the base is formed by the walls of these pockets, and a similar pattern is seen in the cross section. It would appear probable that this resin is derived from the scale insect, and that the peculiar characters of this species are due to the insect on which it is parasitic. Such a structure might conceivably be produced by the growth of a *Hypocrella* on one of the lac insects. The remains of a scale insect are present on the type specimen, but they are not determinable. The walls of the pockets consist of thin-walled hyphæ 1-1.5  $\mu$  diameter, not the usual thick-walled hyphæ of *Hypocrella*. In spores, ascus, and habit, however, the fungus is certainly *Hypocrella*.

*Distribution*.—Singapore, coll. J. Bancroft and coll. H. N. Ridley, in Herb. Kew. Luzon, Merrill 7149 in Herb. Peradeniya.

*Figures*.—Plate 3, fig. 26, specimen *ex* type,  $\times 2$ ; Plate 2, fig. 21, lower surface,  $\times 5$ ; Plate 4, fig. 8, section,  $\times 3$ .

***Hypocrella convexa* Rac.**, Bull. Akad. Sci. Cracovie (1906), p. 908.—Stromata oval in plan, up to 5 mm. diameter, convex, up to 2 mm. thick in the centre, smooth or feebly rugose, margin obtuse or acute, pale ochraceous or yellowish-white, internally white, compact, but rather soft; ostiola red-brown, usually sunk, sometimes slightly elevated, scattered, more numerous towards the margin, sometimes absent in the centre. Perithecia flask-shaped, with a long neck, 0.5 mm. deep, 0.15-0.2 mm. diameter. Asci 210  $\times$  8  $\mu$ ; part-spores cylindric, or slightly barrel-shaped, ends truncate, 6-10  $\times$  1.5-2  $\mu$ .



Type specimen, *ex* Herb. Raciborski, on a scale insect on *Myristica*, Depok, examined. Raciborski (*loc. cit.*) also records it on a scale insect on *Garcinia*, Buitenzorg. The scale insect on the specimen examined is *Lecanium* (? *expansum*). The type specimen bears much resemblance to *Hypocrella scutata*, but has larger part-spores, and is not resinous; the latter point, however, may depend on the scale insect. Another gathering, *ex* Herb. Raciborski, on *Calycodaphne* sp., Java, is apparently the same, but the stromata vary in shape; they are up to 6 mm. in diameter, circular, smooth, convex, thinning out gradually to the margin, or thinning abruptly with a broad thin margin; the perithecial orifices are irregularly scattered, crowded towards the margin, less numerous in the centre, with red-brown, usually sunk ostiola; the part-spores are more mature than in the type, slightly barrel-shaped,  $6-10 \times 1.5-2 \mu$ ; this collection is parasitic on *Lecanium* (? *expansum*).

A specimen in Herb. Kew. on *Lecanium expansum* on *Chisochiton* sp., Perak, coll. H. N. Ridley, may be the *Aschersonia* stage of this species. The stromata are up to 7 mm. diameter, convex in the centre and up to 2 mm. thick, thinning out regularly to the margin, or thinning abruptly into a broad thin margin, which is usually recurved. The pycnidial orifices are situated in minute elevations, numerous towards the margin, few or none in the centre. The pycnidia are regularly flask-shaped or pyriform, 0.3–0.4 mm. deep, regularly arranged near the periphery; the pycnosporos are fusoid, ends pointed,  $8-10 \times 1.5-2 \mu$ .

*Distribution*.—Java, in Herb. Raciborski.

*Figures*.—Plate 3, fig. 27, specimen *ex* type,  $\times 5$ ; Plate 4, fig. 22, section,  $\times 6$ .

***Hypocrella bispora*** v. Höhnelt, Sitzungsber. d. Kais. Akad. d. Wissensch., Wien, CXVIII., p. 826 (1908).—Stromata brownish-black to black, scutate, 3–5 mm. diameter, umbonate in the centre, 1.5 mm. thick, 1 mm. thick at the margin, which is somewhat swollen and rounded, smooth, with a white membrane underlying the stroma; ostiola scattered, scarcely projecting. Internally white or slightly fuscous, with a purplish or blackish peripheral zone about 0.1 mm. deep. Perithecia rather scattered, ovate to flask-shaped, 220–280  $\mu$  high, 110–120  $\mu$  diameter, usually with a long neck up to 120  $\mu$  long; perithecia  $160 \times 95 \mu$ , if the neck is absent. Asci  $80-100 \times 4.5 \mu$ , two- or four-spored. Part-spores cylindric,  $4-6 \times 1.5 \mu$ .

Specimens and slides of this species were kindly lent me by Prof. von Höhnelt. It was collected on leaves of *Pinanga*, at Salak, near Buitenzorg. In shape it resembles flat specimens of

*H. olivacea*, but differs in colour and in the smooth stroma. The white basal membrane underlies the stroma, and does not appear to be attached to it, in the specimen examined, except in the centre; it would seem doubtful whether it is really a part of the *Hypocrella*. Compared with *H. palmicola* the stroma is more compact, the ostiola less prominent, and the perithecia less crowded. It does not give any colour with potash.

*Distribution*.—Java, in Herb. von Höhnelt.

*Figures*.—Plate 2, fig. 8, specimen *ex type*,  $\times 8$ ; Plate 4, fig. 20, section,  $\times 6$ .

***Hypocrella verruculosa* Möller**, *Phycomyceten und Ascomyceten* (1901), p. 299.—Yellow-brown, hemispherical, closely tuberculate, a few millimetres diameter. Conidia not seen. Perithecia scattered, completely immersed, elongated flask-shaped, 600  $\mu$  deep, including the long neck; ascus 270–300  $\mu$  long, four-spored; part-spores 12–15  $\times$  3.5  $\mu$ , oval.

The above description is from Möller, *loc. cit.* I have unfortunately not seen the type specimen, which is not included in the dried specimens in Herb. Berlin; I have since been informed that it is preserved there in alcohol. Möller's figure shows that the species is two-thirds globose, coarsely tuberculate, the tubercles being close set and broadest at the outer end, so that in section the stroma appears furrowed. A slide kindly lent me by Prof. Möller shows that the stroma has a yellow-brown cortex, about 0.15 mm. thick, irregularly incised and undulating; the perithecia are deep-set, and the ostiola sometimes project; the part-spores are narrow-oval, truncate, or almost pointed, 10–16  $\times$  3–4  $\mu$ ; some, if not most, of the asci are eight-spored; some appear four-spored, but it is difficult to determine that with certainty as the sections are unstained; some of the immature asci do not exceed 170  $\mu$  in length, and the sections show immature part-spores measuring only 6  $\times$  1.5  $\mu$ .

Theissen's "*Hypocrella verruculosa*," Rick, *Fungi Austro-Americani*, No. 294, included under that name in Herb. Berlin, contains tuberculate specimens of *Hypocrella phyllogena* only. But Möller's figures and slides do not show any of the characters of the latter species. Ule 872, St. Cathar, pr. Blumenau is included under *Hypocrella verruculosa* in Herb. Berlin, with a note by Hennings that it is "ohne perithecieen," but a letter from Möller, included with the specimens, disagrees with the identification; the specimens are *Munkia martyris* Speg. Thus, the type specimen is the only gathering of this species known up to the present; it may, perhaps, be identical with *Hypocrella epiphylla*.

*Distribution*.—Brazil, Blumenau, on stems of bamboo and *Olyra*.

*Figures*.—Plate 4, fig. 15, section, after Möller,  $\times 2$ .

*Hypocrella javanica* (Penz. & Sacc.) Petch, Ann. Perad., IV., p. 231 (1910).—Stromata hemispherical or two-thirds globose, up to 5 mm. diameter; when small even, or with scattered, projecting ostiola, when large tuberculate, with close-set rounded tubercles up to 0·8 mm. diameter; minutely pruinose at first, becoming glabrous; often surrounded, in the case of small specimens, by a narrow byssoid hypothallus; rather soft in the *Aschersonia* stage, becoming hard; orange or red-brown, internally yellow with a reddish peripheral zone. Pycnidial orifices circular, scattered, sunk, up to 0·2 mm. diameter; pycnidia oval or sub-pyriform, up to 0·5 mm. deep, 0·2–0·3 mm. diameter; pycnospores narrow-oval, ends pointed,  $9-14 \times 2-3\cdot5 \mu$ ; basidia up to  $20 \mu$  high, usually simple,  $1-2 \mu$  diameter, tapering upwards; pycnospores extruded in isolated yellowish masses. Perithecia several in each tubercle, ostiola red-brown, slightly projecting; perithecia flask-shaped, up to 0·5 mm. deep, 0·35–0·4 mm. diameter; asci up to  $180 \times 7-12 \mu$ ; part-spores oblong-oval, ends rounded,  $8-10 \times 2\cdot5-3 \mu$ . *Fleischeria javanica* Penz. & Sacc., Malpighia (1901), p. 230; *Hypocrella vel Aschersonia Randiæ* Koord., in Herb. Berlin. *Aschersonia* stage—*Aschersonia Coffeæ* P. Henn., Hedwigia (1902), p. 145; *Aschersonia pediculoides* P. Henn., Hedwigia (1902), p. 145; *Aschersonia Eugeniæ* Koord., Bot. Untersuch. (1907), p. 214; *Aschersonia Suzukii* Miyabe and Sawada, Jour. Coll. Agric., Tohoku Imp. Univ., V., p. 80.

In my preliminary note, *Hypocrella javanica* and *Aschersonia Coffeæ* were kept distinct. Except for the absence of a hypothallus, the smaller pycnidial stromata of *H. javanica* are indistinguishable from *A. Coffeæ*. The hypothallus is, however, a variable feature in *A. Coffeæ*, reduced in some cases to a very narrow swollen ring, and this latter form can be matched in recent gatherings of *Hypocrella javanica* in Ceylon. The stout basidia and large spores distinguish the *Aschersonia* stage from other *Aschersonias* of the same shape. Potash colours a section purple, especially round the margin.

The type of *Fleischeria javanica* was collected in Java, on living branches of an undetermined tree, Tjibodas. I have not seen the type, but what is undoubtedly the same species is common in the jungle at Hakgala, Ceylon, at an elevation of 5,600 feet, usually on *Lecanum oleæ* on leaves and stems of *Allophylus zeylanicus* L. The *Aschersonia* stromata are usually minute, 1–2

mm. diameter, and even; the *Hypocrella stromata* are up to 5 mm. diameter, tuberculate, and glabrous. In Herb. Berlin, a specimen collected in Java by Koorders is marked *Hypocrella* v. *Aschersonia Randiæ* Koord. A specimen from Brisbane, included under *H. discoidea* at Kew, is most probably this species; it is marked "In the House of Acclimatization on a Japan Orchid," the specimens are hemispherical, tuberculate to almost smooth, minutely tomentose, brownish-red with a narrow white fibrillose margin; internally it shows a broad purplish peripheral zone in section; it appears to be sterile, but Berkeley has noted that the spores are 10–12·5  $\mu$  long.

*Hypocrella javanica* (*Aschersonia* stage) was collected by Thwaites at Nuwara Eliya (Thwaites 255) and forwarded to Berkeley and Broome, who referred to it, in Fungi of Ceylon, sub No. 1027, as "the stylosporous form of some *Nectria*." The type of *Aschersonia Coffæ* in Herb. Berlin, on *Coffea Liberica*, Java, contains small specimens, rather flattened, up to 1 mm. diameter, including a narrow hypothallus up to 0·1 mm. wide; the hypothallus is slightly ochraceous or orange; Hennings gives the length of the basidia as 20–40  $\mu$ , but they do not appear to exceed 20  $\mu$ . *Aschersonia pediculoides* P. Henn., type in Herb. Berlin, on *Jambosia vulgaris*, Java, now contains minute, flattened, almost discoid specimens, up to 0·6 mm. diameter, with a broad fibrillose hypothallus, up to 0·8 mm. wide, giving a total diameter of about 2 mm., as stated by Hennings. Both in *A. Coffæ* (type) and *A. pediculoides* the small specimens may have only a single central pycnidium. *Aschersonia Eugenia* Koord., type in Herb. Berlin, on *Eugenia cymosa* and *Eugenia polyantha* Java, contains specimens up to 1·5 mm. diameter, hemispherical, flattened above or almost discoid, orange, paler below, becoming red-brown above, with a rather stout hypothallus up to 0·5 mm. wide; the first of these gatherings is on the scale, *Vinsonia stellifera* Westw.; the second on *Lecanium* sp.

Parkin's *Aschersonia* No. 4, p. 39, on *Lecanium* (? *coffæ*) on leaves and stems of Tea, Darjeeling, is this species; the stromata are up to 4 mm. diameter and 2·5 mm. high; none of them has a conspicuous hypothallus, but some have a narrow swollen ring round the base; some of these are much larger than any other non-tuberculate examples. Parkin's *Aschersonia* B. 2, on *Lecanium hemisphaericum* var. *coffæ* on Tea, Upper Assam, and B. 3, on *Lecanium* on Tea stem, Kurseong, India, are also *A. Coffæ*. In Herb. Peradeniya are specimens on *Eriochiton theæ* Green, on Tea, Assam, and on *Lecanium hemisphaericum* on *Schizæa digitata*, Ceylon. In Herb. Pusa this species is represented by a gathering on *Lecanium* sp. on Tea, Jorhat district, Assam, coll. A. C. Tunstall.

A specimen in Herb. Kew, marked *Aschersonia Ayresii* Berk., may possibly be this species. It was collected in Mauritius and bears the inscription "*Sclerotium orchidacearum* Ayres. On an *Angræcum*, Port Louis, 1862." The stromata are clustered, two-thirds globose, or distorted by mutual pressure, dusky red-brown,



minutely tomentose, smooth, hard, internally reddish, yielding a yellow extract with potash. They appear to be quite sterile, and their reference to this species is doubtful.

*Hypocrea armeniaca* B. & C. (Amer. Acad. Art & Sci., Boston. IV. (1858), p. 128), on living leaves of *Apocynæ*. Bonin Islands. type in Herb. Kew, is an *Aschersonia* on *Lecanium* sp. The specimens are minute, about 0.5 mm. diameter. They resemble small specimens of *Aschersonia Coffææ*, but are apparently sterile. *Hypocrea armeniaca* B. & C., Grevillea, IV., p. 15, is a totally different species.

*Aschersonia Suzukii* Miyabe and Sawada, from Formosa, is *Aschersonia Coffææ*, according to the type collection in Herb. Sapporo. The specimens are small, not exceeding 2.5 mm. diameter, but have the typical conidia and conidiophores. There is another collection in Herb. Sapporo, sub *Aschersonia Aleyrodis*, said to be on *Aspidiotus aurantii* on *Citrus nobilis*.

*Distribution*.—Java, in Herb. Berlin (*Hypocrella* v. *Aschersonia Randiæ*, *A. Coffææ*, *A. pediculoides*, *A. Eugeniæ*). Ceylon, in Herb. Peradeniya India, in Herb. Pusa and Herb. Peradeniya. ? Queensland, in Herb. Kew (sub *H. discoidea*). Formosa, in Herb. Sapporo.

*Figures*.—Plate 2, fig. 6, smooth *Aschersonia* stage, ex type of *Aschersonia Eugeniæ*,  $\times 6$ ; Plate 2, fig. 11, *Hypocrella* stage, Ceylon specimen,  $\times 6$ ; Plate 4, fig. 23, *Hypocrella*,  $\times 3$ ; Plate 5, fig. 63, pycnospores,  $\times 1000$ .

***Hypocrella Gartneriana* Möller**, *Phycomyceten und Ascomyceten* (1901), p. 299.—Stroma globose, light yellow, fleshy, several centimetres diameter, covered with large, close-set, pulvinate or clavate processes. Perithecia situated at the outer ends of the processes, scattered, half or wholly immersed, globose, about 350  $\mu$  diameter, with a short neck. Ascus 180  $\mu$  long, four-spored. Part-spores 4–6  $\times$  1.5  $\mu$ , rod-like, not separating within the ascus.

The above description is from Möller, *loc. cit.* The type specimen, which I have not seen, is said to be in the spirit collection in Herb. Berlin. Apparently only one example was found. Möller's figure shows that it was about 3 cms. in diameter, exceeding anything else yet recorded in this genus. From the figure showing the cross section, the processes occupy more than half the total thickness of the stroma, and are inflated outwards, so that deep sinuses appear between them in section. In a slide lent me by Prof. Möller, the perithecia are oval, 350–400  $\mu$  deep, with projecting ostiola, the wall of the perithecium being deep yellow-brown. The asci were immature, but some appeared to have more than four spores: unfortunately the slide would not admit of a high magnification. Möller's description of the part-spores,



"not separating in the ascus" indicates immaturity. The species differs from *H. verruculosa* chiefly in the short neck of the perithecium; otherwise it might be considered a large form of the latter.

*Distribution*.—Brazil, on Bamboo.

*Figures*.—Plate 4, fig. 16, section, after Möller,  $\times \frac{2}{3}$ .

**Hypocrella Schizostachyi** P. Henn., Philippine Journal of Science, III., p. 45 (June, 1908).—Stromata two-thirds globose, strongly botryoso-tuberculate, 1.5–2 cms. diameter, very hard, verrucose; internally yellowish with an orange-red zone at the periphery; perithecia flask-shaped, 0.3 mm. deep, 0.15 mm. diameter, body comparatively small, neck long, ostiola slightly projecting. Asci 100–160  $\times$  6–8  $\mu$ , eight-spored. Part-spores cylindric to narrow-oval, 5–8  $\times$  1.5–2  $\mu$ .

The type specimen, on *Schizostachyum* sp., from Luzon, is in Herb. Berlin, and the co-type has been kindly furnished me by Prof. E. D. Merrill. Hennings states that the colour is "cinereo-testaceus," but the specimens now are reddish-purple.

From Prof. von Höhnelt I have received specimens, under the MSS. name of *Fleischeria purpurea*, from Borneo. These are pulvinate or subeonoid, 6 mm. diameter at the base and 5 mm. high. The surface is irregularly furrowed, but appears damaged, as though projecting tubercles had been cut off; one specimen is strongly tuberculate towards the margin, as in *Hypocrella Schizostachyi*. The colour is blackish-purple, internally reddish-purple, but the specimens had been preserved in alcohol, and the internal colour is evidently to be attributed to the diffusion of colour from the exterior layer, since the masses of asci in the perithecia are stained, and, in section, appear a deeper colour than the stroma. The stromata are very hard, and their perithecia and spores agree exactly with those of *H. Schizostachyi*. In my preliminary paper this was included under *H. ceramichroa*, but it would appear to agree better with *H. Schizostachyi*.

*Distribution*.—Philippines, in Herb. Berlin and Herb. Peradeniya. Borneo, in Herb. Peradeniya.

*Figures*.—Plate 2, fig. 7, specimen *ex* co-type,  $\times 2$ ; Plate 4, fig. 17, section, nat. size.

**Hypocrella Amomi** Rac., Bull. Akad. Sci. Cracovie (1906), p. 908.—Stromata circular, up to 4 mm. diameter, pulvinate, up to 1 mm. high, bearing up to twelve erect tubercles, each containing one perithecium; tubercles clavate, flattened at the apex, up to 0.3 mm. high, 0.3–0.4 mm. diameter at the apex, the whole surrounded by a very thin hypothallus, which

may be 2 mm. broad ; yellowish-white, somewhat translucent ; ostiola not projecting, translucent. Perithecia flask-shaped with a long neck, 0.5 mm. deep, 0.2 mm. diameter, wall yellow. Asci up to 400  $\mu$  long, 8–10  $\mu$  diameter ; part-spores fusoid, ends tapering and pointed, 13–16  $\times$  1.5–2  $\mu$ . Pycnidial stroma discoid, top concave, bordered by a white thin hypothallus ; pycnidium central, ostiolum tubular, labyrinthiform below ; pycnosporos fusoid, ends tapering, 8–10  $\times$  1.5–2  $\mu$  ; no paraphyses.

Type specimen, on a scale insert on *Amonum*, Gunung Cakak, Java, ex Herb. Raciborski, examined. The insect was not evident, but there was a single pycnidial stroma present, which indicated, by the absence of paraphyses, that it was parasitic on a species of *Lecanium*. The type of pycnidial stroma is that of *A. cubensis*, but not so elevated. This species bears a considerable resemblance to *Hypocrella botryosa*, but its ascospores (part-spores) are longer. The type collection is not matched by any other gathering seen.

*Distribution*.—Java, in Herb. Raciborski.

*Figures*.—Plate 2, fig. 5, specimen *ex type*,  $\times$  8 ; Plate 4, fig. 21, section,  $\times$  6 ; Plate 5, fig. 60, part-spores,  $\times$  900.

***Hypocrella botryosa*** Syd., *Annales Mycologici*, VIII., p. 39 (1910).—Stromata irregularly oval or circular in plan, 2–3 mm. diameter, consisting of a central, pulvinate or convex, solid mass, sometimes constricted at the base, from which arise numerous (up to 12) erect or horizontal processes, the whole bordered by a thin, hyaline, horny hypothallus. Processes clavate or ovate, strongly inflated outwards, up to 1 mm. diameter at the distal end, each containing several perithecia. Minutely pruinose, pale ochraceous, somewhat translucent. Ostiola yellow to red-brown, not projecting ; wall of the perithecium pale yellow or almost hyaline. Perithecia flask-shaped, 0.3 mm. diameter, 0.5 mm. deep ; asci 130–225  $\times$  8–14  $\mu$  ; part-spores narrow-oval, ends acute, sometimes almost lozenge shaped, 8–11  $\times$  2.5  $\mu$ .

The type specimen in Herb. Sydow is from the Philippines, “on leaves of ? *Cyperaceæ*.” It resembles *Hypocrella Amomi*, but its processes are strongly inflated at the distal end, sometimes almost globose at the extremity, and each contains several perithecia. The stroma is sometimes constricted at the base, and in that case approaches the stud-shaped stroma of *Hypocrella phyllogena*.

*Distribution*.—Philippines, in Herb. Sydow.

*Figures*.—Plate 3, fig. 54, specimen *ex* type,  $\times 8$ ; Plate 4, fig. 18, section,  $\times 4$ .

***Hypocrella nectrioides*** Thaxter *in litt.*—Stroma up to 2 mm. diameter; basal part plano-convex, up to 0.3 mm. thick, bearing numerous clustered, ovoid or turbinate processes, 0.6–0.8 mm. high, 0.5–0.7 mm. diameter, minutely tomentose, the apices of the processes becoming glabrous; rosy orange when fresh (Thaxter), white, slightly translucent, in herbarium specimens. Perithecia single in each process, narrow flask-shaped, up to 0.5 mm. deep, 0.2 mm. diameter, opening rather widely when mature. Asci (part-spores mature)  $300 \times 14 \mu$ . Part-spores narrow-oval, ends obtuse,  $8-12 \times 2.5-3 \mu$ .

On a scale insect on *Pentaclethra* sp., St. Ann's Valley, Port of Spain, Trinidad (coll. R. Thaxter).

In the available specimens the stromata have developed on a scale insect on the rachis of the *Pentaclethra* leaf, and have in consequence encircled the rachis, so that the processes project in all directions. If developed on a flat surface it would no doubt closely resemble *Hypocrella Amomi*, from which it differs chiefly in the shape of the spores and the absence of a scarious hypothallus. On the other hand, it resembles some forms of *Hypocrella Raciborskii*, and it might prove, when the *Aschersonia* stage is known, to belong to the *Aleyrodiicolæ*.

***Hypocrella turbinata*** (Berk.) Petch, Ann. Perad., V., p. 535 (1914).—Stromata simple, subcylindric, about 1.5 mm. diameter and 1 mm. high, expanded at the base into a stout horizontal margin up to 0.25 mm. broad, upper surface truncate, sometimes plane, more usually concave, minutely umbilicate in the centre; or egg-cup shaped; or compound with a solid hemispherical or convex basal stroma up to 4 mm. diameter, from which arise several (up to 12) cylindric or obconic processes with a concave upper surface; white, becoming black when old, minutely tomentose; moderately hard. Pycnidial orifices on the concave disc, sometimes solitary and central; pycnidia irregular, branching internally; pycnosporos narrow-oval, ends pointed, with apparently solid, conical tips about  $2 \mu$  long,  $10-13 \times 3.5-4 \mu$ . Perithecia flask-shaped,  $440 \mu$  long,  $150 \mu$  diameter; asci  $210 \times$

7-8  $\mu$ ; part-spores cylindric, ends rounded,  $10-12 \times 2-2.5 \mu$  (Thaxter). *Aschersonia* stage.—*Aschersonia turbinata* Berk., Ann. Nat. Hist., Ser. 2., IX., p. 192 (1852); *Aschersonia Pittieri* P. Henn., Hedwigia (1902), p. 104.

This is apparently a common species in the West Indies. All specimens hitherto collected have been recorded as *Aschersonia*, but Thaxter has recently shown that the perithecia occur in the basal stroma (Bot. Gaz., LVII., p. 358), not, like the pycnidia, on the concave disc. Large specimens of this species are unmistakable. They consist of a large, pulvinate basal stroma, often cracked and reticulated when old, from which arise, in all directions, what appear to be stout-stalked Pezizas, the stalk being usually obconical, and the upper end expanded into a concave disc. Smaller specimens may bear only one disc; if the basal stroma is developed, they are then constricted in the middle or somewhat egg-cup-shaped. But specimens which have a single disc are often merely columnar, and they may then be confused with *Aschersonia cubensis*; they differ from the latter species in the shape of the pycnospores and in the sharp edge of the disc. The surface of the disc is not sporiferous in the specimens examined; the pycnidia are embedded in the stroma below the disc and open on to it. The colour given above is that of the herbarium specimens; but a communication from Mr. F. W. South states that the stromata are white when young, and pale pink when older, surmounted by a central, red mass of spores. In a collection of small specimens from Trinidad, *ex* Herb. Thaxter, they are yellow.

Berkeley's type specimen, from Nicaragua, in Herb. Kew, contains the largest specimens I have seen; they are up to 1 cm. in diameter, with four or five stalked discs, the discs being up to 4 mm. across. Herb. Paris contains a co-type from Berkeley, and also specimens "C. Wright, Nicaragua, Herb. of the U. S. North Pacific Exploring Expedition, 1853-6." There are also specimens in Herb. Kew, det. Hennings, on *Lucuma caimito* from Brazil, *ex* Herbario Amazonico Musei Parænsis. Herb. Berlin contains specimens from Brazil, on *Chrysophyllum caimito*, coll. Huber, and others on leaves of *Miconia triandra*, coll. Pere Duss, 1901, apparently from Guadeloupe. The type of *Aschersonia Pittieri* in Herb. Berlin, from Cocos Island, Wasser Bay (Costa Rica), on leaves of *Citrus aurantium*, contains poorly developed specimens of *Aschersonia turbinata* on *Lecanium hesperidum* Auctt.

The specimens assigned to *Aschersonia oxyspora* Berk., in Jour. Linn. Soc., XV., p. 394, are small specimens of *A. turbinata*; the name was entered in error under *A. cubensis* in my preliminary paper. This collection has a somewhat involved history, of which the following appear to be the facts. In Hooker's Journal of Botany and Kew Garden Miscellany, VI. (1854), p. 205, Berkeley described *Aschersonia oxystoma* from India. In the same Journal, VIII. (1856), p. 278, he listed a specimen from S. Carlos, Brazil,

collected by Spruce, and compared it with the Indian species, stating that its spores differed in length, but the difference was not enough to constitute a distinct species; he had changed the name to *A. oxyspora*. In Jour. Linn. Soc., X. (1869), Berkeley gave a list of Cuban fungi, and on page 351 of his paper he described *Aschersonia cubensis* B. & C., adding "River Amazon." This addition indicates an extra-Cuban locality for the same species, and as Berkeley stated in his introduction that he had a complete set of Spruce's specimens from the Amazon available for comparison, it is probable that the Amazon record refers to the same specimen as that previously recorded under the name of *A. oxyspora*. In Jour. Linn. Soc., XV., however, Berkeley and Cooke compiled a full account of the fungi of Brazil then known, and there they listed "No. 373. *A. cubensis* B. & C. Cuban Fungi, No. 557, Brazil (M. J. B.)," and "No. 374. *A. oxyspora* Berk.; in Hook. Jour. (1856), p. 278. On dead leaves, S. Carlos, Spruce." It would appear that, as far as Brazil is concerned, these records refer to the same gathering, *i.e.*, that by Spruce, on dead leaves, S. Carlos; this specimen is in Herb. Kew., *sub Hypocrella oxyspora*, and consists, as stated, of small specimens of *A. turbinata*.

In Bull. No. 13, U. S. Dept. of Agriculture, Division of Vegetable Physiology and Pathology, H. F. Webber has recorded *Aschersonia turbinata* from Florida on *Ceroplastes floridensis* on Orange, Mandarin orange, and Hackberry (*Celtis occidentalis*). Webber describes the stromata as white, and states that the conidia when extruded are orange rufous to cinnamon in mass. His figures leave no doubt as to the accuracy of the identification. There are specimens on *Ceroplastes* on *Citrus* from Florida, collected by E. W. Berger, in Herb. British Museum.

Mr. F. W. South has furnished me with specimens from St. Lucia on Java plum, from Dominica on mango, and from Trinidad on *Lecanium* (? *mangiferæ*) on Guava. Some of these specimens are sub-hemispherical, *i.e.*, their sides are convex, not vertical; most of them are truncate and concave above, but one bears two concave surfaces (not stalked), placed obliquely and meeting in a ridge at the apex. The fungus has been recorded from the West Indies as *Hypocrella oxyspora* Mass. Specimens have been sent me from Trinidad and Grenada by Professor Thaxter.

In perithecial specimens from Professor Thaxter, the stromata are hemispherical or subglobose, tuberculate, minutely tomentose. The pycnidial disc is usually situated on one side, sometimes towards the base, and embedded in the stroma, and presents the appearance of having been displaced from its usual apical position by the continued growth of the basal part of the pycnidial stroma.

*Distribution*.—Nicaragua, in Herb. Kew, Herb. Paris, and Herb. Berlin. Costa Rica (*Aschersonia Pittieri*) in Herb. Berlin. Guadeloupe, in Herb. Berlin. Brazil, in Herb. Kew and Herb. Berlin. Trinidad, St. Lucia, Grenada, and Dominica, in Herb. Peradeniya. Florida, in Herb. British Museum.



*Figures*.—Plate 2, fig. 19, *Aschersonia*, simple form, West Indies,  $\times 6$ ; Plate 2, fig. 22, *Aschersonia*, old compound specimen, West Indies,  $\times 4$ ; Plate 3, fig. 49, *Aschersonia*, West Indies,  $\times 6$ ; Plate 3, fig. 50, *Hypocrella*, Grenada,  $\times 6$ ; Plate 4, fig. 33, *Aschersonia*, small form, section,  $\times 6$ ; Plate 4, fig. 34, *Aschersonia* section,  $\times 6$ ; Plate 4, fig. 35, *Hypocrella*, section (after Thaxter); Plate 5, fig. 64, pycnospores,  $\times 1000$ .

***Hypocrella phyllogena* (Mont.) Petch, non Speg.**—Stud-shaped, total height up to 2 mm., consisting of a hemispherical or broadly convex head, 2–3 mm. diameter, narrowed below into a thick stem, which expands at the base into a broad hypothallus; head smooth, or verrucose, or tuberculate, margin regular or incised. Or pulvinate, conical or conico-convex, up to 3 mm. diameter and 1.5 mm. high, bordered by a broad hypothallus. White, yellowish-white, or ochraceous (colour of dried specimens). Hypothallus thin, membranous and hyaline, or byssoid, or stout and tomentose, from 1.5 to 4 mm. wide. Perithecia scattered, only on the head in the stud-shaped forms; ostiola slightly projecting, yellow-brown or red-brown; perithecia flask-shaped, 0.3–0.6 mm. long, 0.15–0.25 mm. diameter; asci 180–225  $\times$  12–14  $\mu$ , eight-spored, spores usually wound in a flat spiral; part-spores cylindric, straight or slightly curved, usually inflated in the middle, 8–14  $\times$  1.5  $\mu$ , or 14–20  $\times$  1.5–2  $\mu$ . Pycnidia flask-shaped, ostiola yellow-brown, situated on the stalk in the stud-shaped forms, scattered in the pulvinate forms; in the latter sometimes irregular and widely open; pycnospores usually narrow-oval or lozenge-shaped with long pointed ends, 10–16  $\times$  1.5–2.5  $\mu$ , points up to 3–4  $\mu$  long, sometimes fusoid, ends pointed, but not produced. *Hypocrea phyllogena* Mont., Ann. Sci. Nat., Ser. II., XIII., p. 340 (1840); ? *Hypocrella citrina* Speg., Fungi Puigg., No. 303 (1889), *fide* Theissen; *Hypocrella abnormis* P. Henn., Fungi Goyazenses, Hedwigia, XXXIV., p. 106 (1895); *Hypocrella ochracea* Massee, Jour. of Bot. (1896), p. 150, t. 357, fig. 10–13 (in part); *Moelleriella sulphurea* Bres., Hedwigia (1896), p. 298; *Hypocrella Edwalliana* P. Henn., Hedwigia (1897), p. 223; *Hypocrella ochracea* Mass., Möller, Phycomyceten und Ascomyceten, 1901; *Hypocrella Weberbaueri* P. Henn., Engler's Bot. Jahrb., XL., p. 226 (1907); *Hypocrella coronata* v. Höhnelt, Denkschr.

Math-naturw. Kl. Akad. Wiss. Wien., LXXIII., p. 22 (1907); *Hypocrella verruculosa* Theiss. non Möller, Ann. Myc., IX. (1911), p. 67. *Aschersonia* stage,—*Aschersonia basicystis* B. & C., Cuban Fungi, No. 558, Jour. Linn. Soc., X. (1869), p. 352; *Hypocrea amazonica* Cooke (in part), Grevillea, XVI., p. 25 (1897); *Aschersonia juruensis* P. Henn., Fungi Amazonici, III., Hedwigia (1904), p. 388; *Aschersonia Puttemansii* P. Henn., in Herb. Berlin; *Aschersonia Chelonix* Speg., in Herb. Speg.; “*Aschersonia oxyspora* Berk.,” in Herb. Speg.; *Aschersonia Jacarandæ* Speg., Mycetes Argent., Ser. V., An. Mus. Nac. Buenos Aires, XX., p. 456 (1910).

The colours given above are those of the herbarium specimens. According to Montagne's description (Ann. Sci. Nat. Ser. II., Vol. XIII., p. 340), this species is orange, with purple perithecial orifices, the perithecia being embedded in a purple zone; the part-spores were said to be curved, and inflated in the middle. His figures show two very minute purplish-red examples, dotted with dark ostiola: in section, the stroma is yellowish below and pinkish above. Montagne stated that it became pale ochraceous when dried. The figures show that the specimens examined by him were stud-shaped, and had part-spores inflated in the middle; neither of these, however, proves to be constant. The type specimen is Leprieur No. 580, on leaves of *Coutarea speciosa*, Cayenne, March, 1839; there is now only one specimen of the fungus in this gathering in Herb. Montagne; it is 2.2 mm. diameter, yellowish-white, constricted below, with scattered perithecial ostiola on the head; it fits Montagne's figure exactly. Another collection in Herb. Montagne is labelled “Leprieur 1121. Jour. second Guyana”; it contains eight specimens, which still show traces of purple, though the general colour is ochraceous; some of these are not stud-shaped, but merely pulvinate or conical; the central portion is up to 2.8 mm. diameter and 1.2 mm. high, bordered by a hypothallus about 1 mm. wide. Another gathering, Leprieur No. 1122, containing four specimens, is in the general collection, Herb. Paris. *Hypocrella citrina* Speg. is said by Theissen (Ann. Myc., IX., p. 66) to be identical with *H. ochracea*, which is *H. phyllogena*; I have not seen the type specimen: the description would fit the latter species. The type specimen of *H. abnormis* P. Henn., in Herb. Berlin, is labelled “Herbarium Ign. Urban. 18,784. Brasilia 1890/91 leg. A. Glaziou”; it contains two leaves, one of which bears a single yellowish-white specimen of *H. phyllogena*, while the other bears five specimens, all but one being much decayed and greenish (through mould?). *Hypocrella Edwalliana* P. Henn., type in Herb. Berlin, “in foliis Lauraceæ, Brasil,” contains stud-shaped as well as pulvinate forms; the former have either smooth or tuberculate heads, and bear perithecia on the head and pycnidia

on the stalk, the pycnospores measuring  $14-16 \times 1.5-2.5 \mu$ ; in the pulvinate forms the pycnidia are irregular, and in one example the centre of the stroma is convoluted, with deep sinuses, resembling an Aleyrodid *Aschersonia*; the description and measurement of the spores given by Hennings is that of the pycnospores. The type of *Hypocrella ochracea* Masee, in Herb. Kew, contains Glaziou 18,806, 18,811, and 18,812, and unnumbered duplicates; 18,811 and 18,812 are apparently on the same plant, while 18,806 and the duplicates are on two other different plants; on the leaf 18,806 there are two species, the *Aschersonia* stage of *H. phyllogena* and *Aschersonia turbinata*; specimen 18,812 is an Aleyrodi *Aschersonia*, *Aschersonia Goldiana* Sacc. & Ellis; the duplicates contain *Hypocrella phyllogena*, with ascospores up to  $20 \times 3 \mu$  and pycnospores with shorter tips than usual, and purple-red sterile specimens which are apparently the same; a packet marked ascigerous by Masee contains one specimen, evidently the same as those in 18,811 and the duplicates. In Herb. Paris Glaziou 18,811 is included under *Hypocrella phyllogena*, while in Herb. Berlin it is placed under *H. Edvulliana*; the species is the same throughout. In the type of *H. Weberbauri* P. Henn., Weberbaur No. 3,601 in Herb. Berlin, the specimens are stud-shaped and up to 3 mm. diameter; the head is hemispherical, smooth, slightly grooved round the margin, brownish or ochraceous; the stalk is short, and the hypothallus either scarcely exceeds the diameter of the head or extends 2 mm. beyond it; the groove between the hypothallus and the head is very narrow and deep; the part-spores measure  $14-20 \times 1.5-2 \mu$ , and are either curved or straight, and sometimes inflated in the middle; some of the specimens are greenish; a note by the collector (?) states that the "thallus" is orange coloured. *Hypocrella coronata* v. Höhnelt agrees with *H. phyllogena*, except in one respect; a specimen supplied by von Höhnelt has a diameter of 4.5 mm. without the hypothallus, and 8 mm. including the hypothallus; it is pale yellow, discoid, 1.5 mm. high, depressed in the centre, with a slight groove at the base; the upper surface is verrucose, and bears numerous tapering, conical appendages, often curved, up to 1 mm. long, usually arising from near the ostiolar; the spores are wound in a flat spiral, and the part-spores are cylindric, slightly ovoid,  $9-12 \times 2-2.5 \mu$ ; it differs from *H. phyllogena* only in possessing these appendages, but the same form occurs in the type specimen of *H. sulphurea* in Herb. Berlin (Möller, 28b). Under *Moelleriella (Hypocrella) sulphurea* Bres., in Herb. Berlin, are two collections, one, the type, Möller 28b, St. Cathar. Blumenau, and the other from E. Ule; both are *H. phyllogena*. *Hypocrea amazonica* Cke, type in Herb. Kew, Spruce No. 528, contains *Aschersonia basicystis*, *A. disciformis*, and an unnamed purple-brown *Aschersonia*. Specimens collected by Rick, Fungi Austro-Americani No. 294, Sao Leopoldo 1907, were assigned to *Hypocrella verruculosa* by Theissen, and are included under that name in Herb. Berlin, while others of the same collection have been lent me by Theissen; this collection contains two forms, the one normal *H. phyllogena*, with the head smooth or

verrucose, and the other probably a parasitized form of the same species. The latter is gray or brownish-gray, lenticular or broadly conico-convex, circular in plan; pycnidia scattered; the stromata appear at first sight to be attached to the leaf over the whole of the base, but a vertical section shows that they are attached by a central disc, separated from the main mass, except in the centre, by a deep narrow cavity; the structure is therefore that of *phyllogena*, but the stalk is much reduced; the basal cavity is lined with basidia which bear minute, oblong-oval pycnosporos,  $4-6 \times 0.75-1.5 \mu$ ; these pycnosporos are similar to those found in parasitized specimens of *Aschersonia placenta*. *Aschersonia basicystis* Berk., the pycnidial stage of *Hypocrella phyllogena*, was described from Wright's Cuban Fungi No. 766; after the description Berkeley added "No. 787 has the same species on leaves from swamps mixed with a tufted *Scytonema*"; the type (No. 766), in Herb. Kew, contains two specimens only: these are stud shaped, with pycnidia on the stalk, the pycnosporos being oval or lozenge-shaped with long thin ends, and measuring  $10-12 \times 2-3 \mu$ ; No. 787 is included under *Aschersonia basicystis* in Herb. Kew, Herb. Paris, and Herb. Berlin (in the latter case, ex Herb. G. Winter), but none of the specimens now contain any *Aschersonia*. The type of *Aschersonia juruensis* P. Henn., Ule 2889, contains only one specimen, and that is very poorly developed; it appears to be *Aschersonia basicystis*, as far as can be ascertained without destroying the specimen, though Hennings described it as having paraphyses; another gathering, under the same name in Herb. Berlin, on *Psychotria* from Peru, Ule No. 3266, also contains only one specimen. *Aschersonia Jacarandæ* Speg. (= *A. Chelonix* Speg. in Herb.) ex Herb. Spegazzini is the pulvinate non-stalked form of *A. basicystis*. Records of "*Aschersonia oxyspora* Berk." from South America usually refer to *A. basicystis* or *A. viridans*. Two specimens of *A. basicystis* collected by Puttemans, No. 916, Alto da Serra, S. Paulo, August, 1902, in Herb. Berlin, are marked *Aschersonia Puttemansii* by Hennings.

Massee (Jour. of Botany (1896), p. 151) stated that the fungus recorded for Brazil by Berkeley under the name of *Aschersonia oxyspora* in Jour. Linn. Soc., XV., p. 394, and Decades of Fungi. No. 615\* (Kew Jour. Bot., VIII., p. 278), is *Hypocrella ochracea*; the specimens, however, are *Aschersonia turbinata*.

In Herb. British Museum there are specimens of *Aschersonia basicystis* in the cover of *Fusarium hypocreoides*, marked *Solenospora hypocreoides* Cke. & Mass., from Jamaica, collected by Mrs. E. M. Swainson.

*Distribution*.—Guiana, Leprieur Nos. 580, 1,121, 1,122, in Herb. Paris. Brazil—18,784 ex Herb. Ign. Urban (*Hypocrella abnormis*); *Hypocrella Edwalliana*; Glaziov 18,811, sub *H. Edwalliana*; Möller 28b (*Moelleriella sulphurea*); Rick No. 294, sub *H. verruculosa*; Ule 2,889 (*Aschersonia juruensis*); Puttemans No. 916 (*A. Puttemansii*), all in Herb. Berlin; Glaziov 18,811, in Herb.



Paris; Glaziou 18,806 (in part) and 18,811, *sub H. ochracea*; Spruce No. 528 (*Hypocrea amazonica*) in part, all in Herb. Kew; *Hypocrella coronata* in Herb. v. Höhnel. Peru, Weberbauer, No. 3,601 (*H. Weberbaueri*); Ule 3,266 *sub Aschersonia juruensis*. in Herb. Berlin. Argentina, *Aschersonia Chelonæ* = *A. Jacarandæ* (*fide* Spg. *in litt.*), in Herb. Spegazzini. Cuba, Wright No. 766 (*A. basicystis*), in Herb. Kew. Trinidad, in Herb. Thaxter. Jamaica, *sub Fusarium hypocreoides*, in Herb. British Museum.

It has been customary to refer to Montagne's species as *Hypocrella phyllogena* (Mont.) Speg., *Fungi Argentini additis nonnullis Brasiliensibus Montevidensibusque*. Pugillus, IV., No. 209. It is so cited in Saccardo, and by Saccardo and Berlese. *Miscellanea Mycologica*, p. 14, "In pagina inf. foliorum *Eupatorii ageratoides*, Madison, Amer. Bor. (Trelease No. 127)." But Spegazzini's specimen so named is not the *Hypocrea phyllogena* of Montagne, but *Hypocrea palmæ* Berk. & Curt., and therefore the reference is incorrect.

*Figures*.—Plate 2, fig. 17, specimen *ex Hypocrella sulphurea* Bres.  $\times 6$ ; Plate 2, fig. 18, *Aschersonia*, *ex* Herb. Paris, Leprieur.  $\times 10$ ; Plate 4, fig. 3, *Hypocrella*, pulvinate form, section,  $\times 6$ ; Plate 4, fig. 4, *Hypocrella*, *ex Hypocrella Edwalliana*, type, section,  $\times 6$ ; Plate 4, fig. 5, pulvinate *Aschersonia* stage, section,  $\times 6$ ; Plate 4, fig. 6, *Hypocrella*, *ex Moelleriella sulphurea*, type,  $\times 6$ ; Plate 4, fig. 7, *Hypocrella*,? parasitized, *ex* Herb. Theissen.  $\times 6$ ; Plate 5, fig. 58, part-spores,  $\times 900$ ; Plate 5, fig. 61, pycnospores,  $\times 1000$ .

***Hypocrella oxystoma* (Berk.) Petch.**—Perithecial stroma irregularly pulvinate, up to 1.5 mm. diameter, 0.8 mm. high, even or slightly tuberculate, pale yellow, waxy, glabrous or slightly pruinose, sometimes with a scarious or fibrillose hypothallus, ostiola not evident. Perithecia narrow-pyriform, 0.5 mm. high, 0.2 mm. diameter. Asci  $320 \times 8-10 \mu$ . Part-spores narrow-oval, ends rounded,  $7-10 \times 2.5-3 \mu$ . *Aschersonia* stromata discoid or columnar, up to 0.75 mm. high, 1 mm. diameter, usually surrounded by a broad scarious or slightly fibrillose hypothallus; waxy-looking and subtranslucent when fresh, minutely tomentose when dry; pale yellow (white in herbarium specimens), mass of spores orange-yellow, central, sometimes forming an erect column projecting above the stroma; upper surface of stroma (when spores removed) marked with a continuous circular furrow about 0.4 mm. deep, a little within the margin; central area often sunk below the outer ring. Pycnidia oval or convoluted in section,



situated below the furrow and opening into it by a narrow ostiolum. Pycnospores  $10-15 \times 2-2.5 \mu$ , with an oval central portion and conical tapering points up to  $3 \mu$  long. *Aschersonia* stage—*Aschersonia oxystoma* Berk., Hooker's Journal of Botany, VI. (1854), p. 205.

This species was described by Berkeley under the name given above, but in the list of new species in Decades of Fungi, XLIX. L. (*loc. cit.*, p. 234), he altered the name to *A. oxyspora*, and added the footnote "not *oxystoma* as in the text." In 1856 he recorded another gathering, from Brazil, under the name *A. oxyspora*, but these latter specimens are small examples of *A. turbinata*. I have retained the original name, as none of the subsequent "*oxyspora*" records refers to the same species.

The type specimen, on leaves of some *Myrsineæ*, India, is in Herb. Kew, but only a minute fragment of one stroma remains; a drawing by Berkeley, however, shows that it was cylindric with an expanded base. Massee recorded that the type specimen was *Hypocrella* (Jour. of Botany, April, 1896, p. 151), and published a description under the name of *H. oxyspora*, but the spores described by him and those in the remaining fragment are the pycnospores.

This species is common in Ceylon in the jungle at Hakgala (5,600 feet), where it occurs on *Sarcococca pruniformis*, *Psychotria elongata*, *Allophylus zeylanicus*, *Acronychia laurifolia*, *Lasianthus* spp., &c. It has also been found at Maha-Iluppallama, in the low-country of Ceylon, on *Memecylon*. The host insect has not been observed. The stromata are, in general, remarkably uniform, but in a few instances pulvinate stromata, bearing three or four furrows, each producing its separate column of spores, have been found. In a collection from Hakgala, Ceylon, on *Murraya exotica*, April, 1917, the stromata are discoid, 0.8 mm. diameter, 0.6 mm. high, with a well-developed membranous hypothallus; the top of the stroma is flat, without the usual sunken furrow, and the pycnidia are scattered, up to six, each producing a separate column of spores.

The perithecial stroma has been found on *Sarcococca pruniformis*, Hakgala, January, 1914.

Records of "*Aschersonia oxyspora*" from South America, other than Berkeley's cited above, have been found, in cases in which the specimens are available, to be *Aschersonia basicystis* or *Aschersonia viridans*.

*Distribution*.—India, in Herb. Kew. Ceylon, in Herb. Peradeniya.

*Figures*.—Plate 2, fig. 16, *Aschersonia*, Ceylon specimen.  $\times 8$ ; Plate 4, fig. 29, *Aschersonia*, section,  $\times 6$ ; Plate 4, fig. 30, section,  $\times 6$ ; Plate 5, fig. 65, pycnospores,  $\times 1000$ .

## ALEYRODIICOLÆ.

*Hypocrella*; subgenus *Eu-hypocrella*.

***Hypocrella discoidea*** (B. & Br.) Sacc., *Michelia*, I., p. 322 (1878).—Stromata usually discoid, up to 4 mm. diameter and 1.25 mm. high, upper surface almost plane, edge vertical or rounded, sometimes umbilicate in the centre, with or without a thin, fibrillose hypothallus; or irregularly pulvinate, 1–2 mm. diameter; minutely pulverulent; orange-red, or more rarely yellow, internally yellowish-white; substance rather soft. Perithecia scattered; ostiola red-brown, or dark brown, slightly projecting; perithecia flask-shaped, 0.35 mm. deep, 0.15 mm. diameter; asci 140–180  $\times$  6–8  $\mu$ , four- or eight-spored; part-spores 8–12  $\times$  2  $\mu$ , cylindric, ends rounded, Pycnidial orifices sunk, each in the centre of a circular scarious area about 0.1 mm. diameter, red-brown, usually circularly arranged; pycnidia flattened-globose or laterally oval, 0.3 mm. diameter, neck short; pycnosporos narrow-oval or fusoid, sometimes slightly inequilateral, ends pointed and slightly produced, 10–15  $\times$  1.5–2  $\mu$ ; paraphyses up to 180  $\mu$  long, rather stout, 1–1.5  $\mu$  diameter. *Hypocrea discoidea* B. & Br., *Jour. Linn. Soc.*, XIV., p. 113 (1873); *Hypocrella Zingiberis* Masee, *Kew Bulletin* (1899), p. 174; *Hypocrella Zimmermanniana* P. Henn., *Hedwigia* (1902), p. 142; *Hypocrella Grewiæ* Koord., *Bot. Untersuch.*, p. 179 (1907). *Aschersonia* stage—*Aschersonia samoensis* P. Henn., *Engler's Bot. Jahrbuch.*, XXIII. p. 289 (1896); *Aschersonia cinnabarina* P. Henn., *Monsunia*, I. p. 37 (1899); *Aschersonia Napoleonæ* Pat. & Har., *Bull. Soc. Myc. France*, XX., p. 65 (1904).

This species is common in the East, at least in the *Aschersonia* stage. The pycnidia and perithecia are not usually found in the same stroma. Berkeley and Broome's type specimen is the *Hypocrella* stage, but immature. Nearly all the collections of

the *Hypocrella* stage are immature, the only recorded exception being *Hypocrella Grewiæ*, of which Koorders states that the spores split up into innumerable part-spores, without giving their measurements. But from Koorders' figures and his illustration of the formation of the part-spores, it is probable that these were merely pycnosporos. The typical discoid form of this species is easily recognized, but it frequently occurs in very small pulvinate forms. It often occurs in company with *Hypocrella Mollii*.

Berkeley and Broome's type specimen from Ceylon is in Herb. Kew and Herb. Peradeniya; it consists of specimens on *Zingiber* and on a dicotyledonous leaf; the latter specimens are on a black *Aleyrodes*; the former are perithecial, but the latter contain pycnidial forms also. The Ceylon specimens on a dicotyledonous leaf were divided between Herb. Berkeley and Herb. Cooke; both parts are now in Herb. Kew, but, probably owing to different methods of preservation, Cooke's half is orange-red, while Berkeley's is yellow. *Hypocrella Zingiberis* Masee, type in Herb. Kew from Perak, is now pale yellow with dark ostiola; some specimens contain both perithecia and pycnidia, but both immature. *Hypocrella Zimmermanniana* P. Henn., type in Herb. Berlin, from Java, on some *Zingiberaceæ*, agrees exactly with the type of *discoidea*, except in colour, which is now yellow, but in this they match Berkeley's specimens noted above; they have evidently been treated with alcohol which has extracted the colour and stained the paper in which they are kept; there are no "substipitate" specimens as described by Hennings. *Hypocrella Grewiæ* Koorders, type in Herb. Berlin from Java on *Grewia microcos*, is the orange-red pulvinate form; similar specimens also occur in Koorders' type specimen of *Hypocrella Mollii*, on *Premna*, from Java, in Herb. Berlin.

*Aschersonia samoensis* P. Henn., type in Herb. Berlin, on leaves of some *Rubiaceæ*, Upolu (Reinecke 61), contains typical discoid forms, surface plane, or depressed in the centre, or irregularly undulating, 1-2.5 mm. diameter and up to 0.4 mm. thick; some have a narrow membranous hypothallus, up to 0.25 mm. wide, in others it is wanting. *Aschersonia cinnabarina* P. Henn., type in Herb. Berlin, on leaves of *Glochidion* sp., from the Philippines, contains minute pulvinate or discoid forms, 1-1.5 mm. diameter; it is on a white *Aleyrodes*. *Aschersonia Napoleonæ* Pat. & Hariot, type in Herb. Paris, on leaves of *Napoleona*, Dahomey, is typical *discoidea*; some of the specimens are *Hypocrella*. From Herb. Pusa, I have examined the *Aschersonia* stage on teak, Burma; on teak, Rangoon (with *Hypocrella Mollii*); on *Aleyrodes* on *Millettia* (?), Travancore; and on *Aleyrodes* on *Spondias mangifera*, Chittagong.

Parkin's *Aschersonia* A. 6, p. 38, on *Aleyrodes* on *Diospyros toposia*, Ceylon, is the typical *Aschersonia* stage. Other Ceylon gatherings include specimens on *Aleyrodes* sp. on *Memecylon* on *Aleyrodes* sp. on *Zingiber*, &c.

*Distribution*.—Ceylon, Herb. Kew and Herb. Peradeniya. India, Herb. Pusa and Herb. Peradeniya. Burma, Herb. Pusa and Herb. Peradeniya. Malaya, Herb. Kew (*H. Zingiberis*). Java, Herb. Berlin (*H. Grewia*; *H. Zimmermanniana*). Samoa, Herb. Berlin (*A. samoensis*). Philippines, Herb. Berlin (*A. cinnabarina*). Africa, Herb. Paris (*A. Napoleonæ*).

*Figures*.—Plate 2, fig. 9, *Aschersonia*, Ceylon specimen,  $\times 6$ ; Plate 5, fig. 35a, *Aschersonia*, section,  $\times 4$ .

***Hypocrella viridans*** (B. & C.) Petch.—Stromata discoid, circular or subpolygonal, up to 2 mm. diameter and 0.5 mm. high; margin sometimes crenulate, sometimes surrounded by a slight powdery hypothallus; grayish-white, becoming greenish; minutely tomentose. Pycnidial orifices circularly arranged, sunk; spore masses pale brown, circular or pyriform, distinct, about 0.2 mm. diameter. Pycnidia flattened-globose, or laterally oval, up to 0.4 mm. diameter, opening at first by a small pore, then widely; pycnospores fusoid,  $12-16 \times 1.5-2.5 \mu$ ; paraphyses up to 200  $\mu$  long. Perithecia scattered; ostiola dark, slightly projecting; perithecia flask-shaped, with a long neck, 0.3 mm. deep, 100–130  $\mu$  diameter; asci 150  $\times 6-8 \mu$ ; part-spores cylindric, ends rounded,  $5-8 \times 1.5-2 \mu$ . *Aschersonia* stage.—*Hypocrea viridans* B. & C., Jour. Linn. Soc., X., p. 756; *Aschersonia viridans* (B. & C.) Pat., Bull. Soc. Myc. France, VII. (1891), p. 48; *Aschersonia disciformis* Pat., Bull. Soc. Myc. France, VIII. (1892), p. 136; *Hypocrea amazonica* Cooke (in part), Grevillea, XVI., p. 25 (1897); *Aschersonia viridula* Sacc., Ann. Myc., XI., p. 547.

All the recorded names refer to the *Aschersonia* stage only. The type specimen of *Hypocrea viridans* in Herb. Kew, from Cuba, is on a black *Aleyrodes* on *Gesneria*; Berkeley described it as pale gray, becoming green. This green colouration is not uncommon in the case of pale-coloured species; it has been noted in *Hypocrella phyllogena*, *Hypocrella Mollii*, &c. The cause of this change has not been ascertained, but it appears to depend on some parasitic or external agency. It is, however, fairly constant in this species. *Hypocrea amazonica* Cooke, in Herb. Kew, from Brazil, contains this species, among others: the specimens are green, up to 1.5 mm. diameter, slightly crenulate, white internally, with large, brown, oval ostiola. The type of *Aschersonia disciformis* ex Herb. Patouillard, on *Cestrum*, Ecuador, is also on an *Aleyrodes*; most of the specimens are crenulate, grayish-green, usually depressed in the centre, without a hypothallus. This species is attributed to *Aschersonia oxyspora* Berk.

by Spegazzini, in Fungi Puiggariani No. 475; the specimens are discoid, depressed in the centre, gray with a slight reddish tinge; there is the same tinge in the centre of some of the stromata in the type of *A. disciformis*. The type of *Aschersonia viridula* Sacc., kindly lent me by Professor Thaxter, is *Aschersonia viridans*; the specimens do not differ from the normal. From the number of specimens submitted to me by Professor Thaxter, *Aschersonia viridans* would appear to be as common in Trinidad as *A. samoensis* is in Ceylon; in one gathering none of the stromata exceed 1.25 mm. in diameter, and some have only one pycnidium; in another, the stromata are slightly elevated in the centre; a third gathering contains *Aschersonia* stromata, *Hypocrella* stromata, and others in which both stages occur. The *Hypocrella* stromata are exactly parallel to those of *Hypocrella discoidea*.

*Distribution*.—Cuba, in Herb. Kew (*Hypocrea viridans*). Ecuador, in Herb. Patouillard (*A. disciformis*). Brazil, in Herb. Spegazzini (Fungi Puigg., No. 475) and Herb. Kew (*sub Hypocrea amazonica*). Mexico (*A. viridula*). Trinidad, in Herb. Thaxter.

*Figures*.—Plate 3, fig. 37, *Aschersonia* stage, ex Herb. Spegazzini,  $\times 8$ ; Plate 3, fig. 38, *Aschersonia*, ex type of *Aschersonia disciformis*,  $\times 8$ ; Plate 5, fig. 49, *Aschersonia*, section,  $\times 6$ .

***Hypocrella palmicola*** P. Henn., in Voeltzkow, Reise Ost-Afrika, III., p. 29 (1908).—Pycnidial stroma circular, flattened pulvinate, or hemispherical, minute, 0.8–1 mm. diameter and up to 0.6 mm. high, upper surface even, or umbilicate in the centre; minutely tomentose; dark chestnut-brown, internally pallid or brownish; pycnidium usually single in the centre of the stroma, laterally oval, 0.3–0.4 mm. diameter, 0.2–0.3 mm. high; pycnospores fusoid,  $4-6 \times 1.5 \mu$ , ends pointed, but not produced; paraphyses up to 130  $\mu$  long. Perithecial stroma discoid, up to 5 mm. diameter, 0.9 mm. thick in the centre, thinning out towards the margin, slightly undulating, sometimes umbilicate in the centre, dark chestnut-brown to blackish-brown, ostiola projecting or not; perithecia broadly flask-shaped, 0.2–0.25 mm. deep, 110–130  $\mu$  diameter; asci  $80-100 \times 4 \mu$ ; part-spores cylindric,  $5-7 \times 1.5 \mu$ .

The type in Herb. Berlin from "Île aux Prunes (O. Madagascar)" contains only one specimen. It is about 5 mm. in diameter, 0.9 mm. thick near the centre, thinning out to 0.2 mm. at the margin. The specimen is rather old, and is now blackish-brown, closely dotted with black ostiola; internally it is brown, with an outer red-brown zone about 0.2 mm. deep. The centre is umbilicate and surrounded by pycnidia, which open into the depression. Elsewhere the stroma bears crowded perithecia



confined to the red-brown zone, with projecting ostiola. The spores in the pycnidia are fused into a brownish mass, and it is not easy to detect the paraphyses. A second gathering of this species was made by Thaxter, on *Adiantum*, Port of Spain, Trinidad. Some of the specimens are only 0·8 mm. diameter, and contain a large central pycnidium with a few perithecia round it. Others are discoid, up to 1·5 mm. diameter, and contain perithecia only; the perithecia in these are scattered, and their ostiola do not project; the internal red-brown zone is lacking in these specimens, but that, as in other species, may be only formed when the stroma is old. The shape of the small stromata, which are wholly or chiefly pycnidial, strongly resembles that of *A. cubensis*.

*Distribution*.—Madagascar, in Herb. Berlin. Trinidad, in Herb. Thaxter.

*Figures*.—Plate 3, fig. 31, *Hypocrella*, Trinidad specimen,  $\times 6$ ; Plate 3, fig. 32, *Aschersonia*, Trinidad specimen,  $\times 10$ ; Plate 4, fig. 19, section, Madagascar specimen,  $\times 4$ .

***Hypocrella Mollii*** Koorders, Bot. Untersuch., p. 179 (1907).—Stromata flattened-pulvinate, or scutate, usually irregularly elevated or undulating, up to 7 mm. diameter and 1·5 mm. thick, often confluent in large patches; white, buff, or yellow; minutely tomentose, sometimes with a byssoid margin; substance white, rather soft. Pycnidial orifices pale brown, scattered, chiefly in the centre; pycnidia elongated flask-shaped, up to 300  $\mu$  long, 160  $\mu$  diameter; pycnosporos fusoid, ends tapering,  $8-14 \times 1-1\cdot5 \mu$ . Paraphyses linear, up to 60  $\mu$  long. Perithecia scattered, ostiola pale to dark brown, not projecting. Perithecia flask-shaped, up to 0·5 mm. deep, 0·2 mm. diameter; asci  $180 \times 6-8 \mu$ ; part-spores cylindric, ends rounded,  $8-12 \times 1\cdot5-2 \mu$ . *Hypocrella cretacea* v. Höhnelt Sitzungsber. d. Kais. Akad. d. Wissensch. Wien, CXVIII., Abt. I., p. 311 (1909). *Aschersonia* stage—*Hypocrea variabilis* Currey (in part), Trans. Linn. Soc. (1876), p. 130; *Aschersonia confluens* P. Henn., Monsunia, I., p. 37 (1899); *Aschersonia phthiurioides* P. Henn., Hedwigia (1902), p. 145.

This is a common species in the Eastern Tropics, usually on a black *Aleyrodes*. It is distinguished by its regular flask-shaped pycnidia, which resemble the perithecia in shape; both may be found in the same stroma. It occurs, often in large numbers, on bamboos, but is not confined to monocotyledons. It may be regretted that von Höhnelt's appropriate name cannot be

retained. The type of *Hypocrella Mollii* on *Premna tomentosa* from Java, in Herb. Berlin, contains small specimens, associated with *Hypocrella discoidea*; the description does not include the latter species; Koorders' measurement of the part-spores (15-17  $\mu$ ) appears to be too large. The type of *Hypocrella cretacea* v. Höhnelt, on *Anomum*, Java, is represented in Herb. Kew, Herb. British Museum, and Herb. Berlin; the part-spores were 8-12  $\times$  2  $\mu$  in the specimens examined by me. *Hypocrea variabilis* Currey, type in Herb. Kew, on *Ochlandra*, Pegu, is a mixture of *Hypocrella Mollii* (*Aschersonia* stage) and *Aschersonia badia*; from Currey's description it is evident that he regarded these as young and old forms, respectively, of the same species; his enlarged figure is not recognizable as either species; the specimen is marked "*Aschersonia*" by Massee. *Aschersonia confluens* P. Henn, on *Leucosyces*, "Luzon, Manila, 13,647 Warburg," type in Herb. Berlin, contains one specimen only. *Aschersonia phthiuriodes* P. Henn., type in Herb. Berlin, on *Lepidadenia Wightiana*, Java, is typical *Hypocrella Mollii* (*Aschersonia* stage) on a black *Aleyrodes*; in some specimens the ostiola are green, in others pale yellowish; this variation has been noted on Ceylon specimens, both colours being found on the same stroma. Other collections examined include specimens on *Citrus decumana*, Java, ex Herb. Raciborski; on *Aleyrodes* on bamboo, probably *Schizotachyum*, No. 10,838, Province of Bulacan, ex Herb. Bureau of Science, Philippines, with *Aschersonia badia*; specimens associated with *Aschersonia badia*, on leaves of *Dilleniaceæ*, Annam, ex Herb. Patouillard; on *Aleyrodes* on teak, Rangoon, ex Herb. Pusa, with *Hypocrella discoidea*.

The specimen from Marquesas, recorded by Berkeley and Broome in Fungi of Ceylon, No. 799, sub *Aschersonia placenta*, and included under that name in Herb. Kew, is the *Aschersonia* stage of *Hypocrella Mollii*.

Collections in Herb. Peradeniya includes specimens on *Aleyrodes* on *Pothos scandens*, Ceylon; on *Aleyrodes* on a dicotyledon, Ceylon (three gatherings); on *Aleyrodes* on *Ochlandra*, Ceylon (four gatherings); on *Aleyrodes* on *Andropogon muricatus*, Ceylon; on *Castanopsis* sp., Shan States, coll. J. H. Burkill; on *Aleyrodes* on teak, Rangoon, with *Hypocrella discoidea*. Parkin's *Aschersonia* A. 3, p. 37, and A. 1, p. 36, are this species.

A large series collected on one occasion, on a black *Aleyrodes* on *Ochlandra*, Ceylon, presents curious abnormal forms. Some specimens are scutate, i.e., with a thin broad border rising gradually into the central pulvinate mass, and do not differ from other gatherings. In others the aleyrodid is surrounded by a circular or oval, irregular, swollen white ring, at a distance of a millimetre or more from the insect. These rings are sterile and up to 4 mm. in diameter, and in some cases adjacent rings coalesce. In some instances a ring of this description surrounds a typical *Mollii* stroma. It would appear that an extraordinarily luxuriant growth of the fungus has resulted in the formation of a ring round the scale instead of a pulvinate mass over it.

C. F. Baker, Fungi Malayana, No. 8, on coccids on *Astromia* sp., Mt. Maquilang, Philippines, issued as *Aschersonia lecanioides*, is apparently this species, but is immature. The specimens are up to 7 mm. diameter, and consist of almost plane, circular, tomentose stromata, in the centre of each of which are developing perithecia (?); the ostiola project, or are situated in small projections, but in this respect the specimens are matched by part of a gathering of *Hypocrella Mollii* on *Pothos scandens*, from Ceylon. I have what is apparently another part of the same Philippine collection, Merrill No. 7,150. in the same condition.

*Distribution*.—Ceylon in Herb. Peradeniya. India, in Herb. Peradeniya. Burma in Herb. Pusa and Herb. Peradeniya. Java, in Herb. Berlin (*H. Mollii*, *H. cretacea*, *Aschersonia phthiurioides*); in Herb. Raciborski (*H. cretacea*); in Herb. Kew (*H. cretacea*); in Herb. British Museum (*H. cretacea*). Annam, in Herb. Patouillard. Philippines, in Herb. Berlin (*A. confluens*), and Herb. Peradeniya. Pegu, in Herb. Kew (*Hypocrea variabilis*). Marquesas, in Herb. Kew (*sub A. placenta*).

*Figures*.—Plate 3, fig. 42, specimen *ex type* of *Hypocrella cretacea*,  $\times 6$ ; Plate 5, fig. 36, section,  $\times 3$ ; Plate 5, fig. 37, section,  $\times 4$ .

***Hypocrella duplex*** (Berk.) Petch.—Stromata pulvinate or subhemispherical, regular, up to 1.5 mm. diameter, scattered, or clustered and confluent, or coarsely tuberculate (?); reddish at the base, pale yellow above, slightly pruinose. Pycnidium single in each stroma, central, globose, about 0.4 mm. diameter; pycnospores fusoid,  $6-10 \times 1-2 \mu$ ; paraphyses linear, up to  $80 \mu$  long. Perithecia several in each stroma or tubercle, ostiola yellow-brown, slightly projecting. Perithecia pyriform, up to 0.5 mm. deep, 0.2 mm. diameter; asci 8-spored; part-spores cylindric,  $4-8 \times 1.5-1.75 \mu$ . *Aschersonia duplex* Berk., in Handbook, New Zealand Flora, Pt. II., p. 623 (1867).

The type specimen in Herb. Kew, on leaves of *Astelia*, contains chiefly minute, simple stromata; there is a tuberculate mass, with large tubercles, but it seems probable that this represents several stromata fused together. Berkeley stated that the stroma is lobed like a raspberry; rarely simple, convex, and containing only one cell; cells variable in size, one or more in each lobe. As far as the specimen now shows, the simple form is the more numerous; the stromata which contain only one "cell" are pycnidial, while those which contain more than one "cell" are perithecial. Diels No. 6,444 on *Icerba brexoides*, Queensland, included under *Aschersonia australiensis* in Herb.

Berlin, is this species: there are only two examples of the fungus; the specimen bears the collector's note that the stromata were orange.

*Distribution*.—New Zealand, in Herb. Kew. Queensland, in Herb. Berlin, sub *Aschersonia australiensis*.

*Figures*.—Plate 3, fig. 25, *Aschersonia*, simple form, *ex* type,  $\times 10$ ; Plate 3, fig. 29, *Hypocrella*, *ex* type,  $\times 8$ ; Plate 5, fig. 40, *Hypocrella*, section,  $\times 6$ ; Plate 5, fig. 41, *Aschersonia*, section,  $\times 6$ .

***Hypocrella tubulata*** Petch, n. sp.—Perithecial stromata white, minutely tomentose, varying from pulvinate, 1.6 mm. diameter, 1 mm. high, slightly tuberculate, or strongly tuberculate with rounded tubercles, 0.4 mm. diameter, to flattened pulvinate, 2 mm. diameter, 0.6 mm. high, strongly tuberculate and irregularly divided; usually with a fibrillose or scarious hypothallus which may be 1 mm. wide in the flatter irregular forms; ostiola slightly elevated, yellow, translucent; perithecia from subglobose, 0.4 mm. diameter, to narrow flask-shaped, 0.2–0.4 mm. diameter, 0.4–0.7 mm. high, embedded singly in the tubercles in the flatter forms, and in the stroma in the pulvinate forms, in the latter case opening through the tubercles if present; asci up to  $200 \times 8\text{--}10 \mu$ ; part-spores cylindric with rounded ends, or narrow-oval,  $7\text{--}12 \times 2\text{--}2.5 \mu$ . *Aschersonia* stromata sometimes pulvinate and even, usually a pulvinate or flattened disc up to 2 mm. diameter, from which arise columnar processes, either abruptly or gradually; processes conical or cylindric, up to 0.6 mm. high, 0.4 mm. diameter, truncate at the apex, with a wide ostiolum which is often laterally compressed; stroma white, minutely tomentose, with a tomentose or fimbriate margin, becoming more compact and subglabrous when old; tissue of the columns composed of more or less parallel hyphæ; pycnidia cylindric, globose, or lenticular, sometimes convoluted at the base, usually with a long cylindrical neck; pycnosporos fusoid, ends blunt,  $8\text{--}10 \times 1.5 \mu$ ; paraphyses linear, up to  $150 \mu$  long.

This species was collected by Parkin, in the *Aschersonia* stage, on an *Aleyrodes* on *Eugenia revoluta*, Horton Plains, Ceylon, and was described by him on page 39 of his paper (*Aschersonia* C). He stated: "The mature stroma possessed a hypothallus surrounding a slightly raised yellow cushion, from which projected

upwards a short column. This bifurcated at the top into two short processes, each ending in a large opening, the pycnidial orifice. One stroma had only a terminal orifice and another had three. The pycnidium is deep and somewhat lobed at the base. The orifices were plugged with yellow-brown or olive-green gelatinous masses of conidia." The remains of this specimen are now in Herb. Peradeniya. The stromata are pulvinate, or conico-pulvinate, up to 1 mm. high, or scarcely elevated, with a narrow hypothallus; some bear one or two short processes; others, immature, bear numerous developing processes; the pycnidia occur singly in each process, or in the body of the stroma; one specimen has a large, flattened-globose pycnidium, 0.8 mm. diameter, and 0.3 mm. high, in the body of the stroma, and smaller (immature) pycnidia, 0.2-0.3 mm. diameter in its processes.

The colour of the spores in mass is usually pale yellow. The green colouration noted by Parkin is a frequent abnormality in Aleyrodiicolous species of *Aschersonia*.

The pycnidial stromata are very variable, but, in general, they may be identified by the long cylindrical neck of the pycnidium. At first glance they may be mistaken for *Aschersonia oxystoma*, with which they sometimes occur, but they are not translucent as in the latter species. The perithecial stromata include forms which resemble *Hypocrella convexa*, others approaching *Hypocrella phyllogena*, and some which resemble a group of confluent neetrias.

This species has been found recently on *Allophylus zeylanicus*, and on *Lasianthus* sp., Hakgala, Ceylon, January, 1914.

*Distribution*.—Ceylon, in Herb. Peradeniya.

**Hypocrella Raciborskii** Zimm., Centralblatt f. Bakt., Bd., VII., Abt. 2 (1901), p. 875.—Pycnidial stromata circular or oval, up to 6 mm. diameter, usually about  $3 \times 2$  mm., flattened pulvinate, up to 1 mm. thick; or subhemispherical, or irregularly pulvinate: often with a broad, translucent, membranous hypothallus, up to 2 mm. broad; white, pale yellow, or orange, rather soft, minutely tomentose, the flatter forms usually covered in the centre by a red, or red-brown, mass of spores. Pycnidia various, usually widely open, irregular, globose or lenticular, lobed cavities, up to  $0.4 \times 0.3$  mm., sometimes flask-shaped with a well-defined neck, up to 0.6 mm. deep and 0.25 mm. diameter. Pycnidial orifices in the flatter forms usually circularly arranged and radially elongated; in the pulvinate forms scattered and circular. Pycnosporos extruded in red or red-brown masses, fusoid, ends acute,  $10-14 \times 1.5-2 \mu$ : paraphyses linear,



40–80  $\mu$  long. Ascigerous stroma developing from the pycnidial stroma, rarely distinct, consisting of globose, ovoid, or cylindric processes, arising round the margin of the flatter stromata, or anywhere on the pulvinate stromata; processes, 0.3–0.7 mm. diameter, up to 0.6 mm. high, white or yellow, pruinose, each containing one perithecium; perithecia elongated flask-shaped, 0.5 mm. deep, 0.3 mm. diameter, wall yellow, ostium translucent; asci up to 220  $\mu$  long, 12–16  $\mu$  diameter; part-spores cylindric, tapering slightly towards the ends, ends truncate (barrel-shaped),  $8\text{--}12 \times 2\text{--}2.5 \mu$ , becoming oval,  $8\text{--}10 \times 3\text{--}5 \mu$ . *Hypocrella Warneckiana* P. Henn., Engler's Bot. Jahrb., XXXVIII., p. 113 (1905); *Barya salaccensis* Rac., Bull. Akad. Sc. Cracovie (1906), p. 909. *Aschersonia* stage—*Aschersonia placenta* B. & Br., Jour. Linn. Soc., XIV., p. 89 (1873); *Aschersonia novoguineensis* P. Henn., Engler's Bot. Jahrb., XXV. (1898), p. 509; *Aschersonia javanica* Penz. & Sacc., Malpighia (1901), p. 236; *Aschersonia lecanioides* P. Henn., Hedwigia (1902), p. 145.

This species is very variable, and it is only with the help of a large series from Ceylon that it has been possible to put the various type collections together. The ascigerous form generally has well-developed processes, but in some cases these are reduced to pulvinate swellings, and in a few instances the perithecia are immersed in the pulvinate stroma. Specimens which do not bear the conidial stage exactly resemble *Hypocrella Amomi*, but the latter differs in the shape of its ascospores (part-spores). The type specimen of *Hypocrella Raciborskii* has been lost (*vide* Zimmermann *in litt.*), but Zimmermann's figure and description fit the other species placed here. Zimmermann described the perithecia near the margin as entirely immersed, but his figure No. 1 scarcely supports that, and, as already stated, this species varies in that respect. Raciborski (*loc. cit.*) noted that the outer perithecia may be almost free (*i.e.*, situated in projecting processes), while those near the centre may be more or less immersed. The type specimen of *Barya salaccensis* was collected on a scale insect on leaves of *Castanea argentea* and *Lasianthus* sp. at Salak and Gedeh, Java; the specimens, *ex* Herb. Raciborski, on *Lasianthus*, include purely pycnidial stromata, as well as those described by him; one stroma is entirely perithecial. *Hypocrella Warneckiana* P. Henn., type in Herb. Berlin, from Amani, on leaves of *Myrianthus arboreus* (Warnecke No. 368) agrees completely with the above, except that the ascospores are in some cases wound in a flatter spiral; this, however, is not constant, even in the same

perithecium. Specimens have been received, *ex* Herb. Sydow, on *Premna odorata*, Manila (coll. P. W. Graff.).

In Herb. Peradeniya there is a specimen of unknown origin, but most probably from Ceylon; it was not seen by Parkin, and was probably collected between 1900 and 1904; its processes are cylindric, with a rounded apex, up to 0.6 mm. high and 0.3 mm. diameter, each containing a single perithecium; its asci, in some examples, show the full development of the part-spores, from cylindric spores,  $8-12 \times 2 \mu$ , to oval spores,  $8-10 \times 3-5 \mu$ , both spores being found in the same ascus.

Another gathering of the *Hypocrella* is contained in Herb. Kew, labelled "on *Smilax barbata*, Singapore." It is apparently immature.

At the time the preliminary note on the Genera *Hypocrella* and *Aschersonia* was published the relationship of *Aschersonia placenta* to *Hypocrella Raciborskii* was not suspected. Recently, however, a large collection of *Aschersonia placenta* on an *Aleyrodes* on *Schleichera trijuga* was made at Peradeniya, which yielded both stages, and a re-examination of the herbarium specimens has left no doubt on that point. The collection was in many respects a remarkable one, as it contained the typical flat *Aschersonia placenta*, the pulvinate *Aschersonia*, which has been named *Aschersonia javanica*, and all possible forms of the ascigerous stage. It was also notable for the large number of stromata present on each leaf, in some instances so densely congregated that they had fused into continuous sheets several centimetres long. At the same time, an *Aleyrodes* on a *Murraya exotica* near by was attacked by the same fungus, and in this case the majority of the stromata were the minute convex-pulvinate form, with a few pycnidia, which has been named *Aschersonia novoguineensis*.

The typical form of *Aschersonia placenta* is readily recognized by its radially-elongated pycnidial orifices arranged regularly round the stroma; at first these appear as red spots on the yellow stroma, but subsequently the masses of spores from adjacent pycnidia fuse and form a red-brown layer over the central portion, leaving only a narrow border free. In addition to this form, however, hemispherical or pulvinate stromata occur, in which the pycnidia are scattered; their ostiola consequently exhibit no definite arrangement, and the spore masses remain separate. Stromata frequently occur, in which the centre is undeveloped, there being merely an annulus, bearing pycnidia, round the scale insect. Flattened and hemispherical examples may occur together, but the former are the more common; there is no other difference between them, except that in some cases the pulvinate forms retain the yellow colour on keeping, while the stromata of the flattened form usually fade to white; this however, is not universal, as the pulvinate forms in the types of *A. novoguineensis*, *A. javanica*, and *A. lecanioides* have all faded.

*Aschersonia placenta* is very near *A. Aleyrodis* Webber, but the latter has a slightly different stroma, and longer paraphyses.

*Aschersonia australiensis* resembles the pulvinate forms of *A. placenta*, but has smaller spores; further examples of *A. australiensis* might prove them identical.

The hypothallus is a variable feature. In extreme cases it forms a broad, thin film, extending irregularly, and sometimes fusing with those of adjacent stromata, but in many collections there is no sign of a hypothallus.

Berkeley and Broome's type specimen, on *Loranthus*, in Herb. Kew and Herb. Peradeniya, contains circular flattened specimens up to 6 mm. in diameter. Part of the same gathering is in Herb. Paris. The specimen from Marquesas mentioned by Berkeley and Broome is *Hypocrella Mollii*. A Brazilian specimen included under *A. placenta* at Kew, labelled "*Hypocrea*, Brazil," by Cooke, is not this species. The type of *Aschersonia novo-guineensis*, on *Ficus* sp., New Guinea, in Herb. Berlin, contains minute examples, white or yellowish, oval, flattened pulvinate, about  $1.5 \times 1$  mm., or circular and convex-pulvinate, about 1 mm. diameter, sometimes furnished with a thin hypothallus; the pycnidia are circularly arranged and numerous in the oval forms, but few and scattered in the circular forms; the paraphyses are 60–80  $\mu$  long, and the spores measure  $10-14 \times 1.5-2 \mu$ ; this form has been gathered in Ceylon. The type of *Aschersonia javanica* from Java, kindly lent me by Professor Penzig, is in poor condition; the leaf bore three specimens, one quite immature and merely the initial stages of a stroma, another discoid, circular, flattened, 1 mm. diameter with a hypothallus 0.1 mm. wide, in which the pycnidia were apparently undeveloped, and a third 1 mm. diameter, irregularly pulvinate, surrounded by a hypothallus 0.2 mm. wide, with three scattered pycnidial orifices; the last-named matches several Ceylon specimens of *A. placenta*.

The type of *A. lecanioides*, on *Mangifera indica*, from Java, in Herb. Berlin, contains pulvinate specimens up to 1.75 mm. thick in the centre, and 5 mm. diameter, including a fibrillose hypothallus, 1–1.5 mm. wide. The pycnidia are scattered, and the stromata have a ring of developing perithecia round the base and on the hypothallus: the spores and paraphyses agree with those of *A. placenta*. Another gathering, in Herb. Berlin, on *Mangifera laurina*, Buitenzorg, Java, collected by Volkens, contains exactly similar specimens, as well as the typical, flattened-pulvinate form of *A. placenta*. Koorders has recorded another collection of *A. lecanioides* from Java, on *Mangifera indica*; this is in Herb. Berlin, but practically nothing is left of it.

Parkin's specimens A 1, on a black *Aleyrodes* on *Andropogon muricatus*; A 2, on a black *Aleyrodes* on *Hedyotis verticillaris*; and A 4, on a pale *Aleyrodes* on *Memecylon capitellatum*, are *Aschersonia placenta*. From Herb. Pusa. I have examined specimens on *Morus indica*, Manipur, Assam; on an unknown leaf, Mussoorie; and on *Aleyrodes* on *Citrus medica*, Ashkoti, Kumaon. It is exceptionally abundant in up-country districts

in Ceylon on a pale *Aleyrodes* on *Loranthus* spp., and frequent in the low-country on *Memecylon* spp.; specimens have also been collected on *Aleyrodes* on *Murraya exotica*, on *Antidesma*, on *Lasianthus Walkeri*, on *Strychnos Benthami*, on *Diospyros Ebenum*, and on *Schleichera trijuga*.

Abnormal forms of *Aschersonia*, which evidently belong to *Aschersonia placenta*, have been observed in two localities in Ceylon, in both cases on an Alexyrodid on *Diospyros Ebenum*. In one case, in the Botanic Gardens, Peradeniya, the specimens are yellow-green or olive-green circular or oval, pulvinate or flattened, usually with a rounded margin, but sometimes expanding into a thin hypothallus. The stroma is firm and corky, yellowish or olive internally. The pycnidia resemble those of *Aschersonia placenta*, but the spores are minute,  $5-7 \times 0.75-1$ , and the paraphyses may reach  $150 \mu$ . The mass of spores and basidia is deep yellow-brown in section. The specimens bear scattered hyphæ, some olive-green,  $4 \mu$  diameter, smooth or strongly roughened with minute warts and spines, and thin, hyaline hyphæ about  $1 \mu$  diameter; these latter appear to penetrate between the normal thick-walled hyphæ of the stroma. Later, the stromata become covered with a "pile" consisting of conidiophores, erect, olivaceous, septate, somewhat irregular, smooth, up to  $160 \mu$  high and  $4 \mu$  diameter; these bear oval, olivaceous conidia  $9-16 \times 4-6 \mu$ . This is a *Cladosporium*, parasitic on the *Aschersonia*; when the hyphomycete is producing conidia, the olivaceous hyphæ of the *Cladosporium* can be recognized within the tissue of the *Aschersonia*.

Another abnormal form was collected in some abundance on the same plant at Sigiriya. The collection includes (1) normal *Aschersonia placenta*; (2) greenish-yellow, corky forms similar to those obtained at Peradeniya, but with immature pycnidia; these bear minutely-roughened hyphæ, which are hyaline, and thinner than in the Peradeniya specimens; some of the stromata are green only on one side; (3) purple forms. These purple stromata are oval or circular, up to 4 mm. diameter, flattened, or pulvinate, or scutate; the pycnidia are generally circularly arranged, and resemble those of *Aschersonia placenta*. The general colour is purple, becoming blackish above, paler and sometimes greenish-yellow at the base. In section the spore mass and basidia are deep yellow-brown, even in unopened pycnidia. In no case is there an extruded spore mass, but only a cohering mass lining the pycnidium. In general the pycnospores measure  $2-4 \times 0.5-0.75 \mu$ , but sometimes they may be  $5-7 \times 0.75 \mu$ . Paraphyses are generally indiscoverable, but in a few cases they occur, and are  $60-80 \mu$  long. The stromata are corky, and yellow-brown to purplish internally. The conidiophores of the parasite have not been observed in this case.

Parkin's specimen A 5, which is *Aschersonia hypocreoidea*, contains similar stromata. They are small, purple, placentiform, up to 1 mm. diameter; the pycnidia are immature, with deep yellow-brown contents.



In the Peradeniya specimens there does not appear to be any doubt that the peculiarities of the stromata are due to the growth of the *Cladosporium*. The greenish-yellow specimens from Sigiriya are identical with these, but the purple forms from the same trees are so different that it might be suggested that either the parasite was a different species, or that the *Aschersonia* on which it grows was not *A. placenta*. On the latter point there is only the evidence that all the other specimens from the same trees are *A. placenta*, but this does not count for much, as it is not uncommon to find two or more species occurring together. But whatever the host, the condition of the contents of the pycnidia indicate that the specimens are parasitized. Similar conditions have been observed in old specimens of *Aschersonia marginata* and *A. sclerotoides*, overrun by *Meliola*, and in *Aschersonia basicystis*.

Fawcett has described a *Cladosporium* parasitic on *Aschersonia Goldiana*, but he does not note any change in the character of the stroma.

*Distribution*.—Ceylon, in Herb. Kew, Herb. Paris, and Herb. Peradeniya (*Aschersonia placenta*). *Hypocrella* stage, in Herb. Peradeniya. India (*Aschersonia* stage) in Herb. Pusa. Singapore, in Herb. Kew. Java, in Herb. Raciborski (*Barya salaccensis*), Herb. Penzig (*Aschersonia javanica*), and Herb. Berlin (*Aschersonia lecanioides*). New Guinea, in Herb. Berlin (*Aschersonia novoguineensis*). Philippines, in Herb. Peradeniya. Africa, in Herb. Berlin (*Hypocrella Warneckiana*).

*Figures*.—Plate 3, fig. 39, *Hypocrella-Aschersonia*, Philippine specimen,  $\times 8$ ; Plate 5, fig. 39, *Hypocrella*, section,  $\times 6$ ; Plate 3, fig. 25, pulvinate *Aschersonia*, Ceylon,  $\times 7$ ; Plate 3, fig. 48, parasitized *Aschersonia*, Ceylon,  $\times 10$ ; Plate 3, fig. 52, two confluent specimens, typical *Aschersonia placenta*, colour of stroma faded, Ceylon,  $\times 10$ ; Plate 5, fig. 43, section,  $\times 10$ ; Plate 5, fig. 56, formation of part-spores,  $\times 800$ ; Plate 5, fig. 59, part-spores,  $\times 900$ .

***Hypocrella Andropogonis*** (P. Henn.) Petch.—Pycnidial stroma usually oval in plan, irregularly pulvinate, up to 6 mm. long, 4 mm. broad, and 1.5 mm. thick; white, minutely tomentose; margin spreading, stromata often confluent; pycnidial orifices circular or irregular, scattered; pycnidia tubular or irregularly oval, widely open, spore masses greenish-yellow, not fusing; pycnosporos fusoid,  $10-14 \times 1.5-2 \mu$ ; paraphyses up to  $140 \mu$  long. Perithecia developed in the stroma between the pycnidia, scattered, flask-shaped, up to 0.4 mm. deep, 0.2 mm. diameter; ostiola yellow-brown, not projecting; asci 4-8-spored; part-spores cylindric, ends



rounded,  $12-15 \times 2 \mu$ . *Aschersonia* stage—*Aschersonia Andropogonis* P. Henn., Hedwigia (1900), p. 139: *Aschersonia parasitica* P. Henn., Hedwigia (1904), p. 149.

In the first examination of Hennings' types of this species I referred them to *Aschersonia Aleurodis*, from which they appeared to differ only in their slightly longer paraphyses. A more extensive collection made by Professor Thaxter in Trinidad has shown that it is distinct, and has furnished the *Hypocrella* stage.

*Aschersonia Andropogonis* P. Henn., type in Herb. Berlin, on *Andropogon*. Mattogrosso, Brazil, is on an *Aleurodes*; the individual specimens are not up to 20 mm. long, as stated by Hennings, this measurement being due to the fusion of several stromata; there are two pieces of grass in the type, one of which bears specimens, somewhat resembling distorted developments of *A. Aleurodis*; the ostiola are arranged more or less circularly round the base; the other piece bears effete specimens, with scattered ostiola. *Aschersonia parasitica* P. Henn., type in Herb. Berlin, on *Andropogon*, K. Fiebrig. Plantæ Paraguayenses, No. 779, is on a black *Aleurodes*; the specimens are very poorly developed and scarcely sufficient for an exact determination, but they appear to be this species.

The Trinidad collection contains a large number of specimens on a grass. The majority are *Aschersonia*; these are white or cream, with irregular, scattered pycnidial orifices. Two specimens are somewhat ochraceous, and bear perithecia in the thickened parts of the stroma between the pycnidia. Though this species belongs to the same group as *A. Aleurodis*, its pycnidia are, in general, more widely separated, and the masses of pycnospores do not, in the available specimens, fuse together. Potash colours a section yellow and gives a yellow extract.

Glaziov 18,812, included under *H. ochracea* in Herb. Kew, is immature *Aschersonia*, but probably this species; the stromata attain a diameter of 6 mm. A specimen in Herb. Kew from Brazil, included under *A. placenta*, is also probably referable to this species; it bears considerable resemblance to Glaziov 18,812, but is *Hypocrella*, its perithecia being filled with interlacing hyphæ; the stroma is white, almost plane, dotted with pale yellow ostiola.

*Distribution*.—Trinidad, in Herb. Thaxter. Brazil, in Herb. Berlin (*A. Andropogonis*). Paraguay, in Herb. Berlin (*A. parasitica*).

*Figures*.—Plate 2, fig. 20, *Hypocrella*, Trinidad, ex Herb. Thaxter:  $\times 5$ ; Plate 3, fig. 53, *Aschersonia*, Trinidad, ex Herb. Thaxter,  $\times 6$ .

*Hypocrella Sloaneæ* Pat., in Duss, Enum. Champ. Guadeloupe, p. 80 (1903).—Pycnidial stromata circular, 1-2 mm. diameter, discoid, consisting of a central conidiiferous disc,

surrounded by a white tomentose swollen border, or sometimes with a white tomentose central area also; conidial mass red-brown. True pycnidia absent (?), the sporiferous area flat; conidia narrow-fusoid, ends tapering and pointed,  $10-14 \times 0.75-1.5 \mu$ ; paraphyses linear, up to  $100 \mu$  long. Ascigerous stroma developed on the margin of the conidiiferous stroma, or independently; circular or oval, up to 4 mm. diameter or  $5 \times 4$  mm., up to 2 mm. thick, plane or slightly pulvinate, tuberculate; tubercles rounded above, up to 0.4 mm. high, and 0.4 mm. diameter at the base; substance rather loose; white or cream coloured, ostiola dark-brown. Perithecia one in each tubercle, ostiola projecting, flask-shaped, 0.5 mm. deep, 0.3 mm. diameter; asci  $200 \times 8 \mu$ ; part-spores narrow-oval to fusoid, ends rounded or pointed, sometimes slightly inequilateral,  $10-16 \times 2-3 \mu$ . *Hypocrella amazonica* P. Henn., Fungi Amazonici II., Hedwigia, XLIII., p. 246 (1904).

The typespecimen in Herb. Patouillard, on leaves of *Sloanea* sp., Guadeloupe, is on an *Aleyrodes*. The stromata are circular or oval, pulvinate, tuberculate, now dirty brown to whitish, slightly translucent, with or without a narrow subfibrillose hypothallus; some effete *Aschersonia* stromata (?) are present, which apparently indicate that this stage may vary to a form with fairly regularly arranged pycnidia.

The description of the *Aschersonia* stage given above is taken from the type specimen of *Hypocrella amazonica* P. Henn.; this, "E. Ule, Herbarium Brasiliense, No. 3,198. On *Sterculiaceæ*, Peru. Iquitos, July, 1902," is in Herb. Berlin and Herb. Kew. This contains conidial forms, mixed conidial and ascigerous forms, and purely ascigerous forms. Some of the stromata are crowded with tubercles, others scarcely tuberculate. The mass of conidia may be circular, occupying the centre of the stroma, or ring-shaped, with central and marginal white areas; there does not appear to be any pycnidium in these, the conidiophores arising from a flat sunken area. The perithecia are embedded in the loose tissue of the tubercle and underlying stroma, except at the apex, which projects about  $50 \mu$ . The asci are chiefly immature, but some part spores, cylindric,  $8-14 \times 1 \mu$ , can be found.

*Distribution*.—Peru, in Herb. Kew and Herb. Berlin (*H. amazonica*). Guadeloupe, in Herb. Patouillard. Trinidad, in Herb. Thaxter.

*Figures*.—Plate 3, fig 30, *Hypocrella*, with *Aschersonia*, ex type of *Hypocrella amazonica*,  $\times 12$ ; Plate 3, fig 40, *Hypocrella*, ex type of *Hypocrella amazonica*,  $\times 8$ ; Plate 5, fig. 38, section, *Hypocrella* and *Aschersonia*,  $\times 4$ .

*Aschersonia* : subgenus *Eu-aschersonia*.

**Aschersonia badia** Pat., Journal de Botanique (1897), p. 370.—Stromata discoid, circular, up to 3 mm. diameter and 0·5 mm. high, sometimes with a slight whitish fibrillose hypothallus; upper surface plane, or depressed in the centre, or occasionally radially grooved, minutely tomentose; yellow-brown or reddish-brown, blackening when old. Pycnidial orifices dark, up to 0·1 mm. diameter, circular, arranged in a circle or scattered. Pycnidia globose, 0·25 mm. diameter, with a short conical neck, about 0·1 mm. long; pycnosporos narrow-oval or lanceolate,  $10-13 \times 2-2\cdot5 \mu$ ; paraphyses up to 100  $\mu$  long. *Hypocrea variabilis* Currey (in part), Trans. Linn. Soc., Ser. 2, Vol. I. (1876), p. 130.

The type specimen, in Herb. Patouillard, is on a Dilleniaceous plant from Tonkin; many of the specimens are blackish-brown, but are parasitized by a *Cladosporium*; some small white specimens in the type are *Hypocrella Mollii*. *Hypocrea variabilis*, in Herb. Kew, from Pegu on Bamboo, contains both *Aschersonia badia* and *Hypocrella Mollii*, as does also a specimen from the Philippines, Norzagaray, Province of Bulacan, Herb. Bureau of Science, No. 10,838. The latter specimen is on an *Aleyrodes* on bamboo; some of the stromata have a slight whitish fibrillose hypothallus; the paraphyses reach 80  $\mu$ . Parkin's *Aschersonia* A 4, p. 37, on *Aleyrodes* sp. on *Memecylon capitellatum*, Ceylon, contains *Aschersonia badia* as well as *A. placenta*. Another Ceylon gathering, on *Aleyrodes* sp. on *Antidesma*, has the pycnidial orifices elevated in one specimen; a single stroma of *Hypocrella discoidea* occurred with these.

*Distribution*.—Ceylon, in Herb. Peradeniya. Tonkin, in Herb. Patouillard. Philippine Islands, in Herb. Peradeniya. Pegu, in Herb. Kew (*Hypocrea variabilis* in part).

*Figures*.—Plate 3, fig. 47, Philippine specimen,  $\times 6$ ; Plate 5, fig. 50, section,  $\times 6$ .

**Aschersonia crenulata** Pat. & Har., Journal de Botanique (1900), p. 244.—Stromata circular, discoid, up to 1·75 mm. diameter and 0·5 mm. high, often depressed in the centre, margin rounded and somewhat crenate or incised at the upper edge; slightly contracted below, minutely tomentose; pale purple-gray or purple-brown, internally fuscous. Pycnidial orifices circularly arranged, dark, sunk. Pycnidia globose,

about 0·3 mm. diameter, with a short conical neck; pycnosporos fusoid, ends pointed,  $10-14 \times 2-2\cdot5 \mu$ ; paraphyses up to 160  $\mu$  long. *Aschersonia tephrosiicola* P. Henn., Fl. du Bas et Moy. Congo, Vol. II., fasc. III (1908), p. 228.

The type specimen, in Herb. Paris, is on *Lonchocarpus* and *Smilax*, from West Africa. *Aschersonia tephrosiicola*, type in Herb. Berlin, is on a pale *Aleurodes* on *Tephrosia*; the specimens are discoid, but rather irregular, thinning out towards the margin and somewhat nodular; the paraphyses are up to 160  $\mu$  long. This species is very near *A. badia*, but has longer paraphyses.

*Distribution*.—Africa, in Herb. Paris, and Herb. Berlin (*A. tephrosiicola*).

*Figures*.—Plate 3, fig. 33, specimen *ex type*,  $\times 6$ ; Plate 5, fig. 51, section,  $\times 10$ .

*Aschersonia brunnea* Petch, n. sp.—Stromata circular, discoid, up to 2 mm. diameter and 0·6 mm. high; sometimes depressed in the centre; dark purplish-brown, internally pale brown. Pycnidial orifices circularly arranged or scattered, blackish; pycnidia globose, up to 0·35 mm. diameter; pycnosporos lanceolate, ends tapering,  $16-19 \times 2-2\cdot5 \mu$ ; paraphyses up to 160  $\mu$  long. *Hypocrea amazonica* Cooke (in part), Grevillea, XVI., p. 25.

This species resembles *Aschersonia badia*, from which it differs in its larger pycnidia, larger spores and longer paraphyses. It is included in Herb. Kew under *Hypocrea amazonica* Cooke, Spruce No. 528, from Brazil.

*Distribution*.—Brazil, in Herb. Kew.

*Figures*.—Plate 3, fig. 34, specimen *ex Hypocrea amazonica* Cke. in Herb. Kew,  $\times 10$ ; Plate 5, fig. 53, section,  $\times 6$ .

*Aschersonia flava* Petch, n. sp.—Stromata discoid, margin rounded, usually contracted below, up to 3 mm. diameter, 0·8 mm. thick, yellow or orange when fresh, waxy, subtranslucent, pallid and pruinose when dry, sometimes surrounded by a pruinose area on the leaf, pycnidial orifices not evident. Stroma with a loose central region in the centre of the base. Pycnidia arranged more or less in a circle, regular, pyriform, or globose with a conical neck, 0·3 mm. diameter, 0·5 mm. high, ostiola not projecting. Paraphyses linear, up to 200  $\mu$  long. Pycnosporos fusoid, inequilateral, ends acute,  $12-14 \times$

2.5  $\mu$ . On an *Aleyrodes* on *Ochlandra*, Avissawella, Ceylon, October, 1909; Hapugastenna, Ceylon, October, 1909.

*Distribution*.—Ceylon, in Herb. Peradeniya.

*Aschersonia blumenaviensis* P. Henn., Hedwigia (1902), p. 27.—Stromata up to 3 mm. diameter, circular, discoid, up to 1.25 mm. thick, margin rounded above and below, constricted at the base, surrounded by a thin fibrillose hypothallus up to 1 mm. wide, upper surface sometimes umbilicate in the centre; lemon-yellow; minutely pruinose. Pycnidial orifices circularly arranged, circular, darker than the stroma, scarcely depressed, about 0.05 mm. diameter, with a thin, scarious margin. Pycnidia flattened-globose, up to 0.5 mm. diameter, 0.3 mm. deep, with a conical neck 0.1 mm. high; pycnospores fusoid, ends pointed,  $10-16 \times 1.5-2.5 \mu$ ; paraphyses 90–180  $\mu$  long. *Aschersonia flavocitrina* P. Henn., Hedwigia (1902), p. 307; *Aschersonia abnormis* P. Henn., Hedwigia (1904), p. 93: not *Aschersonia flavocitrina* of Florida writers.

It may be regretted that the more appropriate name of *flavocitrina* cannot be retained for this species. *Aschersonia blumenaviensis*, type in Herb. Berlin, Möller No. 67, Brazil, contains old bleached specimens only; Hennings gives the spore measurement  $15-18 \times 1.5-2 \mu$ . *Aschersonia flavocitrina*, type in Herb. Berlin, on *Psidium*, Brazil, collected by Puttemans, San Paulo, contains lemon-yellow stromata; Hennings gives the measurement of the spores as  $12-18 \times 2 \mu$ , and the paraphyses  $140-180 \times 1-1.5 \mu$ . This is a discoid species, with regularly arranged subglobose pycnidia as in *H. discoidea*, *A. badia*, &c., but is almost stud-shaped, owing to the contraction of the stroma below; at first glance it may be mistaken for a very short stalked form of *A. basicystis*. It bears no resemblance to the Florida species which has been recorded under the name of *A. flavocitrina*. The type of *Aschersonia abnormis*, in Herb. Berlin, on *Bambusa*, Rio de Janeiro, Ule, 2,640, contains two examples only of the fungus: one of them is 4 mm. diameter, discoid, about 1 mm. thick in the centre, with a regular rigid margin about 1 mm. wide, interrupted on one side; the other is 2 mm. diameter, and its margin is irregularly convoluted; the pycnidia contain a brownish mass of spores, which are only  $5-8 \times 1 \mu$ ; the paraphyses are scanty, and attain a length of 80  $\mu$  only; it appears to be an abnormal development of *A. blumenaviensis* parallel to the small-spored, parasitized forms of *A. basicystis*, &c.

*Distribution*.—Brazil, in Herb. Berlin.



*Figures*.—Plate 3, fig. 51, specimen *ex* type of *Aschersonia flavocitrina*,  $\times 6$ ; Plate 5, fig. 52, section,  $\times 5$ .

**Aschersonia Tamurai** P. Henn., Engler's Bot. Jahrb., XXXI., p. 741 (1902).—Stromata circular or oval, up to 1.5 mm. diameter, discoid or flattened pulvinate, up to 0.5 mm. thick, sometimes with a narrow, membranous or fibrillose hypothallus up to 2 mm. broad, waxy; orange, pale yellow, or white. Pycnidial orifices more or less circularly arranged, circular, few; pycnidia flask-shaped, up to 0.3 mm. deep and 0.15 mm. diameter, or subglobose; pycnosporos extruded in a reddish-orange mass, fusoid,  $8-12 \times 1.5-2 \mu$ ; paraphyses about 50  $\mu$  long.

The type specimen, on *Quercus cuspidata*, Japan, in Herb. Berlin, contains stromata up to 2 mm. diameter, with or without a thin, membranous hypothallus; the stroma is pale yellow or white, and the spore mass orange; there are also old, black, effete specimens, in which no details are recognizable. Specimens, *ex* Herb. Sydow, on *Ilex pedunculosa*, Japan, contain stromata as in the type, others depressed in the centre, and some reduced to a horseshoe-shaped stroma surrounding the scale: some have a narrow, white, fibrillose hypothallus; this gathering is mixed with the sterile, lenticular, purple-red stroma which is frequent on *Aleyrodidae* in the Eastern tropics (*Aschersonia zeylanica* Berk. in herb.). In Herb. Sapporo, there are specimens of *Aschersonia Tamurai* on *Aleyrodites citri*, September 4, 1906, attributed to *Aschersonia Aleyrodites*. *Aschersonia Tamurai* rather closely resembles some forms of *Aschersonia plucenta*. On the present material it differs in the smaller, obscure, pycnidial orifices, not radially elongated, and in the more regular flask-shaped pycnidia.

*Distribution*.—Japan, in Herb. Berlin, Herb. Peradeniya, and Herb. Sapporo.

*Figures*.—Plate 3, fig. 36, specimen *ex* Herb. Sydow,  $\times 10$ ; Plate 5, fig. 47, section,  $\times 10$ .

**Aschersonia taitensis** Mont., Ann. Sc. Nat., Ser. 3, Vol. X. (1848), p. 122.—Stromata discoid, up to 1 mm. diameter and 0.4 mm. high, minutely tomentose, without any evident hypothallus; pale yellow, with circular, or linear and curved, yellow-brown masses of spores. Pycnidia ovoid, crowded, irregularly circular or oval in section, sometimes convoluted at the base; pycnosporos fusoid, ends pointed but not produced,  $10-14 \times 1.5-2 \mu$ ; paraphyses up to 70  $\mu$  long.

The type specimen, the only gathering, of this species is now in Herb. Paris, and a co-type in Herb. Kew. It was collected on leaves of *Cyrtandra*, Tahiti. There is a large number of examples of the fungus, but they are very small, ranging from about 0.5 mm. to 1 mm. The original description gives the size of the stroma as to 1-2 mm. In general, they are discoid, *i.e.*, circular with a flat top, but a few are slightly convex above. Montagne stated that the perithecia (*i.e.*, pycnidia) are ovoid with a short neck, the ostiola being "per rimulas extus conjunctis"; the latter feature is characteristic of *A. oxystoma*, in which the ostiola are united by a circular furrow, and it also occurs in *A. Tamurai*.

His figures show the pycnidia flask-shaped in vertical section, and circular in cross section, scattered through the stroma. In the specimen examined by me, the apparent number and shape of the pycnidia varied according to the height of the transverse section from the base. The pycnidia were crowded together, and irregular because of their proximity. In cross section they were irregularly oval or circular, frequently lobed, up to  $0.3 \times 0.2$  mm. The lower sections showed (apparently) a greater number of pycnidia than those taken in the upper region of the stroma. It would appear, therefore, that the pycnidia are roughly ovoid, irregularly lobed, and convoluted at the base; and they open either by a small pore or by an elongated, linear orifice. The pycnidia thus resemble to some extent those of *A. placenta*, but they do not, in the available specimens, open so widely, nor do the extruded spores fuse into a continuous mass. The fungus gives a yellow extract, and becomes yellow to orange red (in section) with potash.

In Montagne's published figure (*loc. cit.*) the spore is shown as septate, but his original drawing shows them guttulate.

This species is near *Hypocrella discoidea*, from which it differs in its crowded and irregular pycnidia. Its spores are, on the average, smaller and its paraphyses shorter, but were it not for the shape of the pycnidia it might be included in *discoidea*.

*Distribution*.—Tahiti, in Herb. Paris and Herb. Kew.

*Figures*.—Plate 3, fig. 35, specimen *ex type*,  $\times 12$ ; Plate 5, fig. 42, section,  $\times 10$ .

**Aschersonia Aleyrodis** Webber, Bull. No. 13, U. S. Department of Agriculture, Div. of Veg. Phys. and Path. (1897), p. 20.—Stromata flattened pulvinate, up to 2 mm. diameter, 2 mm. thick, usually surrounded by a thin membranous hypothallus up to 1 mm. broad; minutely tomentose, rather soft, pinkish-buff or cream-coloured. Pycnidia sometimes flask-shaped, usually irregular, convoluted; pycnidial orifices scattered or circularly arranged, circular or oval. Pycnosporos fusoid.

ends rather blunt,  $10-14 \times 1-2 \mu$ , extruded in coral-red or rufous masses which cover the centre of the stroma; paraphyses linear,  $65-100 \mu$  long,  $0.75-1 \mu$  diameter.

This species closely resembles *Aschersonia placenta*, from which it differs in its thicker stroma and longer paraphyses; the pycnidial orifices are usually circularly arranged and radially elongated, but, owing to the thickness and more pulvinate form of the stroma, they are not flat, as in *placenta*, but subvertical, i.e., on the sloping sides of the stroma. The light and dark lengths in the paraphyses are strongly marked in some examples of this species, but, as in other species, they are not a constant feature. Florida specimens from H. J. Webber and H. S. Fawcett have been examined. A peculiar feature of these specimens, which, however, may not be constant, is the presence of a column (as seen in section) of non-sporiferous tissue in the middle of the pycnidium; in other species it is, as a rule, possible to wash out all the spores from the section, leaving only the continuous fringe of conidiophores and paraphyses; but in the specimens of *A. Aleynodis* examined, this fringe is interrupted in the middle by a column of tissue continuous with the tissue of the stroma.

*Distribution*.—Florida, specimens per H. S. Fawcett and H. J. Webber in Herb. Peradeniya. Trinidad, ex Herb. Thaxter. The Japan and Formosan specimens attributed to *Aschersonia Aleynodis* are *Aschersonia Tamurai*, *A. hypocreoidea*, and *A. Coffæ*.

*Figures*.—Plate 3, fig. 44, old herbarium specimen, Florida,  $\times 10$ ; Plate 5, fig. 44, section,  $\times 10$ .

***Aschersonia hypocreoidea*** (Cooke & Masee) Petch.—Stromata circular or oval, up to 3 mm. diameter, almost plane, about 0.25 mm. thick, tomentose or byssoid, sometimes surrounded by a thin, membranous or powdery hypothallus, white, rarely yellow. Pycnidia in the centre of the stroma, arranged irregularly or in a circle, concave, widely open, sometimes somewhat flask-shaped and convoluted at the base; spore masses pale yellow or orange yellow, distinct or confluent; pycnosporos narrow-oval or lanceolate, ends pointed but not produced,  $8-13 \times 2-2.5 \mu$ ; paraphyses up to  $120 \mu$  long. *Fusarium hypocreoideum* Cooke & Masee, Grevillea, XVI., p. 76 (1888); *Aschersonia Zenkeri* P. Henn., Engler's Bot. Jahrb., XXIII. (1897), p. 541.

The type specimen of *Fusarium (Selenospora) hypocreoideum* in Herb. Kew, contains small specimens, up to 1.2 mm. diameter sometimes with a powdery or membranous hypothallus up to 1.5

mm. wide. They are rather more pulvinate than is usual, and up to 0.45 mm. thick. Some are flattened-pulvinate, with scattered pycnidia, others are almost horseshoe-shaped, with circularly-arranged pycnidia. The paraphyses attain a length of 120  $\mu$ , and some show light and dark lengths. The pycnosporos are narrow-lanceolate,  $10-13 \times 2-2.5 \mu$ . The specimen is marked "589, on leaves of *Ficus aspera*, Brisbane." A specimen in Herb. British Museum, marked *Selenospora hypocreoidea* Cke. & Mass., from Linstead, Jamaica, Mrs. E. M. Swainson, is *Aschersonia basicystis*.

The type specimen of *Aschersonia Zenkeri*, on an undetermined leaf from Bipindi, Cameroons, Zenker No. 43, is in Herb. Berlin; as some of the stromata bear developing perithecia at the margin it is evidently the *Aschersonia* stage of a *Hypocrella* approaching *H. Raciborskii*; the paraphyses show well marked light and dark lengths. *Aschersonia paraphysata forma Balanseaana* Sacc., ex Herb. Saccardo, on leaves of *Boehmeria*, Tonkin, is *A. hypocreoidea*. Parkin's specimen A 5, p. 37, on *Aleyrodes* sp. on leaves of *Flemingia strobilifera*, Peradeniya, is this species; the light and dark lengths are well-marked in some paraphyses, but not in others in the same pycnidium; this collection contains, in addition to the usual thin forms, minute pulvinate specimens with a few central pycnidia. In another Ceylon gathering on *Aleyrodes* sp. on *Argyrea populifolia*, the stroma is sometimes a mere film, with scattered superficial spore masses. Specimens ex Herb. Raciborski, on *Unona* sp., Depok, Java, have also been examined. The specimens issued in Sydow, Fungi exotici exsiccati, No. 192, as *Aschersonia novo-guineensis*, on leaves of *Ficus ulmifolia*, Philippines, are *A. hypocreoidea*.

The pycnidial stage of *Hypocrella Raciborskii* differs in its pulvinate stroma, shorter paraphyses, and red-brown spore masses.

*Distribution*.—Ceylon, in Herb. Peradeniya. Tonkin, in Herb. Saccardo. Java, in Herb. Raciborski. West Africa, in Herb. Berlin. Philippines, in Sydow, Fungi exotici exsiccati, No. 192. Formosa, in Herb. Sapporo (*sub A. Aleyrodis*). Australia, in Herb. Kew (*Fusarium hypocreoideum*).

*Figures*.—Plate 3, fig. 41, Ceylon specimen,  $\times 8$ ; Plate 5, fig. 45, section,  $\times 10$ . The processes at the margin of the stroma in fig. 41 are due to the growth of the stroma over the hairs of the leaf, and are not a normal feature of the fungus.

***Aschersonia Goldiana* Sacc. & Ellis, Sylloge Fungorum, XIV., p. 990 (1899).**—Stromata up to 6 mm. diameter, oval or circular, flattened-pulvinate, up to 1.5 mm. thick, minutely tomentose, white or pale yellow, sometimes surrounded by a membranous hypothallus. Pycnidial orifices scattered or circularly arranged, ultimately hidden by the orange-yellow

mass of extruded spores. Pycnidia up to 0.2 mm. deep, cylindric and narrow, or concave and widely open, forming irregular shallow pits with a convoluted base; pycnosporos orange-yellow in mass, fusoid or narrow-oval, ends pointed but not produced,  $8-14 \times 1.5-2 \mu$ ; paraphyses 50-110  $\mu$  long. *Aschersonia paraensis* P. Henn., Hedwigia (1902), p. 17; *Aschersonia flavocitrina* in Fawcett, Fungi parasitic on *Aleyrodes citri*, &c., not *Aschersonia flavocitrina* P. Henn.

Herb. British Museum contains a specimen of this on *Vitex*, Para, coll. Cockerell, which is apparently part of the type collection; it is identical with the specimen sent by Cockerell to Ellis, and now in the Everhart Herbarium. The stromata are up to 4 mm. diameter, almost plane or slightly pulvinate, white, minutely tomentose, with pale orange yellow or yellow spore masses; the pycnidia are poorly developed and irregularly distributed, the masses of spores forming irregular lines; a broad membranous hypothallus is present. The type of *Aschersonia paraensis*, on *Psidium pomiferum*, Brazil, in Herb. Berlin, contains pulvinate stromata, up to 1 mm. thick in the centre, circular, 3 mm. diameter; the pycnidia are irregularly oval, convoluted below, and when fully open constitute a convoluted pseudo-disc hidden by a thick mass of spores; the stroma is white and the pale orange mass of spores occupies the centre, leaving a narrow white margin exposed; the pycnosporos are  $8-12 \times 1.5 \mu$ , and the paraphyses 50-100  $\mu$  long. Herb. Berlin contains two other gatherings under the same name, one, on dead leaves, Rio Jurua, collected by Ule, and the other on *Psidium Guayava*, Jutuba, Ilha de Marajo, collected by Huber; in the latter the stromata are up to 3 mm. diameter, often confluent, pulvinate, up to 1.5 mm. thick; some have a membranous hypothallus up to 1.5 mm. wide, in others it is wanting.

From Florida I have examined specimens on *Aleyrodes citri*, Manatee, Florida (H. J. Webber), and on the same insect from H. S. Fawcett. The stromata are comparatively small, up to 2.5 mm. diameter, sometimes furnished with a broad, spreading, membranous hypothallus; in the flattened-pulvinate examples the pycnidial orifices are irregularly scattered, but in thin specimens they may be arranged regularly in a circle and radially elongated as in *A. placenta*; the spores are  $8-14 \times 1.5-2.5 \mu$ , and the paraphyses, 60-100  $\mu$  long; the flattened-pulvinate specimens are exactly *A. paraensis*.

Fawcett states that the most evident distinction between *A. Goldiana* and *A. Aleyrodis*, as they occur in Florida, is in the colour. "*A. aleyrodis* is usually red or pink, while *A. flavocitrina* is yellow, and never contains any reddish pigment. The stromata of *A. aleyrodis*, under similar conditions, average less in diameter, and the pycnidial cavities are usually more sunken than in



*A. flavocitrina*. The spores of *A. aleyrodis* also average a little smaller than those of *A. flavocitrina*. Measurements of Florida specimens show that the spores of *A. aleyrodis* are about  $9-14 \times 2-3 \mu$ , while those of *A. flavocitrina* measure about  $12-15 \times 2-3 \mu$ . The paraphyses of *A. Goldiana* are slightly longer, and the stromata are thinner and do not exhibit the oblique ostiola of *A. aleyrodis*.

In Herb. British Museum there is a specimen from Venezuela: "Plantes du Haut-Orenoque, Recueillies en 1887 par A. Gaillard. No. 230 de la collection. *Fusarium salmonicolor* B. & C., sur feuilles de Psidium, village d'Atures, 9. Aout"; this is *Aschersonia Goldiana*, approaching in form *Aschersonia hypocreoides*.

*Distribution*.—Florida, in Herb. Peradeniya. Brazil, in Herb. British Museum and Herb. Berlin (*A. paraensis*). Trinidad, in Herb. Thaxter. Porto Rico, in Herb. Thaxter. Venezuela, in Herb. British Museum (Gaillard, 230, *sub Fusarium salmonicolor*).

*Figures*.—Plate 3, fig. 46, Florida specimen,  $\times 6$ ; Plate 5, fig. 46, section,  $\times 10$ .

***Aschersonia australiensis*** P. Henn., Hedwigia (1903), p. 87.—Stromata circular or oval, up to 2 mm. diameter, flattened-pulvinate, up to 1 mm. thick, surrounded by a broad membranous hypothallus, waxy and subtranslucent; orange-yellow or grayish-yellow. Pycnidia scattered or arranged circularly; ostiola yellow; pycnidia ovoid, or more or less flask-shaped; pycnospores narrow-oval or fusoid, ends pointed but not produced,  $5-10 \times 1-1.5 \mu$ ; paraphyses up to  $70 \mu$  long.

The type specimen, from Queensland, Pritzel, 79, in Herb. Berlin, is on an *Aleyrodes* on *Callistemon lanceolatus*. In the same cover is a gathering on *Icerba brexoides*, Diels, 6,444, which is *Hypocrella duplex*. The type contains pulvinate, subtranslucent stromata, sometimes depressed in the centre and displaying the scale insect; its spores are  $5-8 \times 1-1.5 \mu$ . It resembles pulvinate forms of *A. placenta*, some of which, e.g., those named *A. javanica*, become subtranslucent, but differs in its smaller spores. But the available material is scanty. In Herb. Kew, *sub A. oxyspora*, there is a Queensland gathering on *Cinnamomum Olivieri* which is, in part, this species; some of these stromata are more opaque; the spores measure  $5-10 \times 1-1.5 \mu$ .

*Distribution*.—Queensland, in Herb. Kew and Herb. Berlin.

*Figures*.—Plate 3, fig. 43, specimen *ex type*,  $\times 10$ ; Plate 5, fig. 48, section,  $\times 10$ .

***Aschersonia columnifera*** Petch, n. sp.—Stromata up to 2.5 mm. diameter, feebly pulvinate, bearing about four erect,

or suberect, columnar processes, pale yellow, minutely pruinose, total height about 0.7 mm., usually with a scarious hypothallus; processes cylindric, often laterally compressed, up to 0.5 mm. high,  $0.6 \times 0.4$  mm. in cross section; pycnidial orifices at the apices of the processes, usually solitary, oval, rarely two and circular, mass of pycnosporos usually brownish-yellow, sometimes red-brown; pycnidia regular, shortly cylindric, about 0.2 mm. broad and deep; pycnosporos fusoid, ends pointed but not produced,  $14-20 \times 2-2.5 \mu$ ; paraphyses linear, up to 130  $\mu$  long. On an *Aleyrodes* on *Ilex dahoon*, Florida.

This species was included in a collection forwarded by Mr. H. S. Fawcett. At first sight, the stromata resemble small specimens of *Aschersonia turbinata*, from which it especially differs in the presence of paraphyses. It resembles the *Aschersonia* stage of *Hypocrella tubulata*, but has a different pycnidium and longer pycnosporos. From *Aschersonia acutispora*, from Australia, it differs in the shape of the pycnosporos. No other species resembling this has been seen from the Western Tropics.

***Aschersonia acutispora*** Petch, n. sp.—Stromata yellowish, opaque, simple, cylindric, about 0.8 mm. high, 0.6 mm. diameter, with a broad scarious hypothallus, up to 1 mm. wide, or (?) botryose, with clustered processes up to 0.5 mm. high and 0.3 mm. diameter; pycnidia (in the simple forms) single, central, flattened-globose, about 0.3 mm. high and 0.4 mm. diameter; pycnosporos narrow-oval, tapering abruptly towards the ends,  $10-14 \times 2-2.5 \mu$ ; paraphyses up to 180  $\mu$  long. On an *Aleyrodes* on *Cinnamomum Olivieri*, Queensland, in Herb. Kew.

In the cover of *Aschersonia oxyspora* in Herb. Kew there is a gathering from Queensland, which is in part *Aschersonia australiensis*, and in part the present species, which differs from *Aschersonia australiensis* in the shape of the stroma and the spores. The fertile stromata are all simple, but botryose forms are also present, which appear to be the same species. Unfortunately, the botryose forms examined were immature. *Aschersonia duplex* has a similar pycnidium, but its paraphyses are shorter, and its spores a different shape. The spores of *Aschersonia acutispora* resemble those of *Aschersonia oxystoma*, but the latter does not possess paraphyses, and its pycnidia are different.

The material is scanty, but it cannot be included in any other known species.

## SPECIES NON VISÆ.

**Hypocrella citrina** Speg., Fungi Puiggariani, No. 303, Bolet. de l' Academia Nacional de Ciencias de Cordoba, XI. (1889), p. 381.—“ Stromatibus hypophyllis, sparsis vel hinc inde laxe 2-3-gregariis, hemisphærico-lenticularibus, glabris, hypothallo hyalino, pelliculoso, radiante, 3-4 mm. diam. superficiali insidentibus, superne applanatis ac sæpius papillulosis, 1-2 mm. diam.; peritheciis globulosis, immersis, in margine stromatis sæpius constipatis, 250  $\mu$  diam.; ostiolo papillulato, non vel vix exserto: ascis cylindraceis, subfusoides, apice rotundato-truncatis, crasse tunicatis, 1-foveolatis, deorsum breviter attenuato-pedicellatis, 120-130  $\times$  6-8  $\mu$ , octosporis, aparaphysatis: sporidiis filiformibus, hyalinis, continuis vel rarius in articulos secedentibus, 100-110  $\times$  1  $\mu$ . Ad folia emortua Myrtaceæ vel Xanthoxyleæ cujusdam in silvis pr. Apiahy Brasilæ.”

Theissen states (Ann. Myc., IX., p. 66) that this is *Hypocrella ochracea* Mass., but he does not appear to have seen the type specimen; the general shape would agree with that of the latter species.

**Hypocrella colliculosa** Speg., Fungi Puiggariani, No. 301, loc. cit.—“ Stromatibus epiphyllis, nervisedis, subgregariis hemisphærico-colliculosis, pallide subaurantiis, glabris, 1.5-3 mm. diam., 1-1.5 mm. cr.; peritheciis periphericis, globosis, 250-300  $\mu$  diam., stromate immersis, plus minus prominulis: ostiolo vix papillulato; contextu carnuloso, indistincto; ascis cylindraceis, apice subtruncato-rotundatis, tunica non vel vix incrassata, basi brevissime crasseque subattenuato-pedicellatis, 8-sporis, 200  $\times$  10  $\mu$ , aparaphysatis: sporidiis filiformibus, 200  $\mu$  long., in articulos, 5-10  $\times$  3  $\mu$ , secedentibus hyalinis. Ad folia viva Rubiaceæ arboreæ cujusdam in silvis pr. Apiahy, Brasilæ.”

Apparently not now represented in Herb. Spegazzini. The description does not apply to any known species.

**Hypocrella luteo-olivacea** Wint., Grevillea, XV., p. 86.—“Stromatibus subglobosis v. crasse pulvinatis, sessilibus, ramulos tenuiores conferte circumdantibus, superficialibus, facile solubilibus, sæpe mutua pressione plus minus angulatis, extus luteo-olivaceis, peritheciis parum exstantibus verrucosis, intus luteis, circ. 1–3 mm. lat.; peritheciis immersis, vertice tantum prominulis, elongato-ovoideis, in collum crassum, conicum attenuatis, 150–180  $\mu$  lat.; ascis elongato-cylindraceis, deorsum stipitiformi-attenuatis, 8-sporis, 180–200  $\times$  9  $\mu$ ; sporidiis filiformibus, hyalinis, dense septatis et (in ascis) in articulos cylindricos, utrinque truncatos, 8–9  $\times$  2.5  $\mu$  secedentibus. Ad ramulos emortuos S. Francisco in Brasilia (Ule No. 337).”

The type specimen is apparently not in Herb. Kew, Herb. British Museum, or Herb. Berlin. The description suggests *Hypocrella palmæ*. In Herb. Berlin there is a specimen, *sub H. luteo-olivacea* Wint., labelled “Brasilia: Prov. Sao Paulo: auf Myrtaceæ sp. Leg. F. Noack. Comm. P. Sydow.” The stromata are subglobose, wrinkled, up to 3 mm. diameter, dirty white, with brown ostiola, which do not project; they are hard, and white internally. The perithecia are flask-shaped, up to 0.45 mm. deep and 0.15 mm. diameter; the wall of the perithecium is yellow. The part-spores are oval, 9–12  $\times$  3–4  $\mu$ . This appears to be the *Hypocrella* form of *H. cavernosa*.

**Hypocrella globosa** Rac., Bull. Acad. Sci. Cracovie (1906), p. 907.—“Stromatibus globosis basi angustata in pagina superiori foliorum insidentibus, 2–3.5 mm. diameter, cartilagineis, griseo-nigris, intus albidis: peritheciis subpiriformibus et supra collo elongato præditis, 360–400  $\times$  100–122  $\mu$ , parietibus flavo-aurantiacis, immersis sed ostiolo papilliformi, prominulis; paraphysibus nullis; ascis lineari-fusoideis, apice rotundatis, 160–190  $\times$  8  $\mu$ , octosporis; sporidiis anguste linearibus in asco secedentibus et tunc articulis breviter cylindraceis, hyalinis levibus, 2.5–4  $\times$  1–1.5  $\mu$ . In foliis præcipue ad nervos Castilloæ elasticæ, Buitenzorg in ins. Java.”

Notwithstanding the small size given for the part-spores, this species would appear to be *Hypocrella Reineckiana*.

**Aschersonia chætospora** Sacc., Florula Mycol. Lusitanica, Bol. Soc. Broter. Coimbra, XI. (1893), p. 69.—“Stromatibus

hypophyllis, subsolitariis, pulvinatis, carneo-flavidis, intus pallidioribus, 1 mm. diam., carnosio-fragilibus, levibus : contextu sinuoso-celluloso ; peritheciis peripherice immersis globulosis, remotiusculis, pallide fuscellis, poro circulari ampliusculo non emergente apertis : sporulis creberrimis, fusoideis, rectis, continuis,  $8 \times 2 \mu$ , hyalinis, utrinque setula recta,  $4 \times 1 \mu$  acutis. In foliis nondum emortuis Sabiceæ ingratae, S. Thome."

This, from the description, is a Lecaniicolous *Aschersonia*, apparently near *Aschersonia cubensis*.

**Aschersonia paraphysata** Sacc., *loc. cit. supra*,—"Stromatibus hypophyllis, subsolitariis, pulvinatis, superficialibus, levibus, intus et extus fusco-violaceis, contextu tortuoso-celluloso ; peritheciis globulosis, immersis, in quoque stromate paucis (4-8), ostiolo circulari non exserto pertusis : sporulis fusoideis, utrinque acutis sed non setigeris, continuis,  $9 \times 2 \mu$ , rectis, hyalinis, basidiis bacillaribus fultis paraphysibusque filiformibus prælongis,  $200-240 \times 1 \mu$ , hyalinis obvallatis. In foliis nondum emortuis Sabiceæ ingratae, S. Thome."

The type specimen of this and the last species are on a single leaf (*fide* Saccardo *in litt.*). *A. paraphysata*, from the description, should be a species similar to *Aschersonia badia*, and the description of the stroma suggests *Aschersonia crenulata*, but it differs from all known discoid species in the length of its paraphyses. But *A. paraphysata* forma *Balanseana*, from Tonkin, in Herb. Sacc., is *Aschersonia hypocreoidea*, which belongs to quite a different group.

**Aschersonia lauricola** Speg., *Mycetes Argentinenses*, Ser. V., An. Mus. Nac. Buenos Aires, XX. (1910), p. 457.—"Stromata globoso-depressa, inferne cingulo oculigero cineta, superne ruga concentrica infossa etiam oculigera ornata, subsuberosa, extus rubra intus alba : sporulæ pusillæ cylindraceo-fusoideæ utrinque acutæ. Stromata 1-3 mm. diam. : oculi superi globosi,  $100-150 \mu$  diam. : sporulæ  $6-8 \times 1.5 \mu$ . Ad corpora emortua Cocci (*Aleurodes* ?) cujusdam ad folia viva Phœbe in silvis Jujuy, Jun., 1909."

From the description this is a Lecaniicolous species, but it does not agree with any species I have seen. The description of the stroma would fit some forms of *Aschersonia basicystis*.



## SPECIES DUBÆ.

**Hypocrella? Gardeniæ** P. Henn., Hedwigia (1893), p. 223.—“Stromata hypophylla pulvinata, pallide brunea, carnulosa, 1 mm. diam., subiculo pallido insidentia: asci non visi: sporidia in articulos hyalinos fusoideis,  $8-10 \times 3 \mu$ , dilabentia. In foliis Gardeniæ floridæ in horto Bogor, Java.”

The note of interrogation is Hennings's. After the description Hennings wrote that, although he had made several examinations of the fungus, he had not succeeded in finding asci. On the other hand, he found spores in abundance. He was of opinion that the fungus belonged to *Hypocrella*, judging from the character of the stroma, which was exactly the same as that of *Hypocrella semen* Bres., though the spores appeared to be produced in a different manner.

The type specimen is not in Herb. Berlin. *Hypocrellasemen* is not a *Hypocrella*, but a Discomycete, and if the supposed *Hypocrella* (*Gardeniæ*) resembled it, it may doubtless be rejected. But it would seem possible that the specimen may have been *Aschersonia Coffea*.

**Hypocrella Engleriana** Koord., Bot. Untersuch. (1907), p. 177.—“Stromatibus carnosus, pulvinatis, basi constrictis, extus fuscis, 0.5–1 mm. cr., hypophyllis: peritheciis immersis; ascis cylindræis, 60–65  $\mu$  longis, 4–5  $\mu$  latis, 8-sporis; sporidiis filiformibus asci longitudinem subæquantibus, 1  $\mu$  latis, dense minute septulatis ac guttulatis, tarde in articulos secedentibus. In foliis emortuis Mangiferæ indicæ Java.”

The type specimen in Herb. Berlin bears a note which states that the fructifications are entirely immersed; that may, however, refer to the perithecia. The leaf bears two minute, black, carbonaceous bodies, pulvinate, not constricted below; it is possible that these may be effete *Hypocrella*, but they are too old for determination. There is nothing now which corresponds to Koorder's figures.

**Hypocrella Tamoneæ** Earle, Mycologia, II., p. 87.—“Stromata scattered, hypophyllous, 1–1.5 mm. in diameter, black (at least in aged specimens), suborbicular, crust-like, superficial; perithecia crowded, prominent, finally collapsing, 200–250  $\mu$  diameter; ostiola perforate, large, somewhat irregular: asci cylindrical, short-stipitate,  $80-100 \times 7-8 \mu$ ; spores thread-like, very slender, equalling in length the ascus, spirally coiled, about  $80 \times 0.75 \mu$ : paraphyses numerous. On living leaves of *Tamonea* sp., Porto Rico.”

In its collapsible perithecia, and in the presence of paraphyses in the perithecium, this species differs from every *Hypocrella* known. Its reference to *Hypocrella* appears very doubtful.

## SPECIES EXCLUDENDÆ.

**Hypocrella Bambusæ** (B. & Br.) Sacc., *Michelia*, I., p. 323 ; *Hypocrea Bambusæ* B. & Br., *Jour. Linn. Soc.*, XIV., p. 113.—Stroma composite, consisting of a mass of mycelium which binds together the inner leaves of the bud and produces an external ascigerous stroma at the apex. Ascigerous stroma black, hemispherical, plane below, somewhat flattened above, about 1·5 mm. diameter, rough with close-set, conical ostiola which project up to 0·1 mm. Perithecia flask-shaped, usually close-set, sometimes wedge-shaped, regularly arranged round the periphery of the upper portion of the stroma, up to 0·6 mm. deep and 0·2 mm. diameter. Asci about  $400 \times 4-6 \mu$  ; spores filiform, almost as long as the ascus,  $1-1\cdot5 \mu$  diameter, continuous in the available specimens. On bamboo, Ceylon.

From the structure of the stroma, this species is evidently *Balansia* ; it has been described as *Balansia Bambusæ* (B. & Br.) Petch, in *Ann. Perad.*, VI., p. 170.

**Hypocrella axillaris** Cooke, *Grevillea*, XX., p. 4.—Stroma composite, including the leaves, &c., of a lateral shoot, adherent along one side to the subtending leaf, black, pulvinate, tapering to one end, wrinkled, almost smooth, up to 5 mm. long, 3 mm. diameter, and 2 mm. high. Perithecia flask-shaped, close-set, about 0·3 mm. deep and 0·15 mm. diameter ; ostiola scarcely projecting. Asci  $180 \times 5 \mu$  ; spores filiform, as long as the ascus,  $1-1\cdot5 \mu$  diameter, septate. On grasses, Brisbane.

This species is *Balansia*, and has been described as *Balansia axillaris* (Cooke) Petch, in *Ann. Perad.*, VI., p. 171. In *Journal of Botany*, 1896, p. 152, Masee stated that *Hypocrella Bambusæ* is identical with *Hypocrella axillaris*, but, except that both are *Balansia*, the two species have no resemblance to one another.

**Hypocrella pulvinulus** (B. & Br.) Sacc., *Sylloge Fungorum*, II., p. 581 ; *Epichloe pulvinulus* B. & Br., *Jour. Linn. Soc.*, XIV., p. 111.—Sterile stroma white, composite, enclosing the bud, producing an external fertile stroma at the mouth of the leaf sheath. Fertile stroma honey-coloured, with brown subtranslucent ostiola, flattened pulvinate (flattened parallel to the stem of the plant), up to 3 mm. long, 2 mm. broad, and 1 mm. thick, pale brown internally. Perithecia flask-shaped, crowded in a distinct peripheral zone, wall rather thick, up to 0·5 mm. long, 0·15 mm. diameter ; asci cylindric.

capped, cap with a central pore,  $250-300 \times 5-6 \mu$ ; spores filiform, as long as the ascus, septate. On *Panicum* sp., Ceylon.

This species has the same structure as *Balansia*, but its stroma is light coloured; it has been re-described as *Balansiella pulvinula* (B. & Br.) Petch, in Ann. Perad., VI., p. 173.

**Hypocrella Panici** Masee, Kew Bulletin, 1899, p. 173.—Stroma 2-3 cm. long, 2 mm. diameter, black, composite, consisting of fungus hyphæ and the enclosed leaves, &c., of the shoot, adherent to a leaf along one side; perithecia crowded in a distinct peripheral zone, flask-shaped, up to 0.3 mm. high, 0.1 mm. diameter; ostiola slightly projecting; asci cylindric,  $175-225 \times 4-6 \mu$ , pedicel up to 50  $\mu$  long, tapering; spores almost as long as the ascus, 1-1.5 diameter, hyaline, continuous (in the available specimens).

This species is *Balansia*, and will stand as *Balansia Panici* (Masee); as the thickness of the stroma, above the embedded leaves, &c., is only 0.7 mm., it might perhaps be transferred to *Dothichloe*, but the shape and structure of the stroma is exactly that of *Balansia brevis* (B. & Br.) v. Höhnelt.

**Hypocrella hypoxylon** (Peck) Sacc., Sylloge Fungorum, II., p. 581; *Epichloe hypoxylon*, Peck, 27th Report, p. 108; *Balansia hypoxylon* (Peck) Atkinson, Jour. of Mycology, XI., p. 254.

This species appears to have been correctly placed by Atkinson in *Balansia*.

**Hypocrella atramentosa** (B. & C.) Sacc., Michelia, I., p. 323; *Hypocrea atramentosa* B. & C., Cuban Fungi No. 758; *Dothichloe atramentosa* (B. & C.) Atkinson, Jour. of Mycology, XI., p. 260.

This is the type species of the genus *Dothichloe* which includes species with stromata similar in structure to those of *Balansia*.

**Hypocrella tuberiformis** (Berk. & Rav.) Atkinson, Bot. Gazette (1891), pp. 256 and 258; *Dussiella tuberiformis* (Berk. & Rav.) Pat., Bull. Soc. Myc. France, VI. (1890), pp. 107-109 (in part); *Hypocrea tuberiformis* Berk. & Rav., Cooke, Grevillea, XII., p. 105.

Reference has previously been made to this much-discussed species. Whether all the forms described under these names are identical or not, it is clear from the descriptions that none of them is *Hypocrella*.

**Hypocrella Cyperacearum** (Berk. & Curt.) Sacc., *Sylloge Fungorum*, II., p. 580, *Hypocrea Cyperacearum* B. & C., *Exot. Fungi Schwein.*, p. 285.

The specimens appear to be *Dothichloe*, and resemble *D. atramentosa*.

**Hypocrella semiamplexa** (Berk.) Sacc., *Michelia*, I., p. 323 ; *Hypocrea semiamplexa* Berk., *Decades of Fungi*, No. 483.

The stroma is about 3 inches long, parasitic on bamboo. It is apparently *Balansia*.

**Hypocrella semen** Bres., in Hennings, *Fungi Brasilienses*, II., p. 524. ; *Hypocrella Glaziovii* P. Henn., *Fungi Brasilienses*, II., p. 524.

These two species were described from Glaziou 18,069. The type of *Hypocrella semen* is in Herb. Berlin ; the packet contains a MSS. description by Hennings, under the name of *Hypocrea foliicola*, and is marked by Hennings "et *Helotiella Glaziovii*." The type of *Hypocrella Glaziovii*, also in Herb. Berlin, is part of the same collection.

Bresadola states that the asci of *Hypocrella semen* are 220-270  $\times$  8-9  $\mu$ . with filiform multiseptate spores. Hennings gives the asci of *Hypocrea foliicola* as 180-230  $\times$  7-8  $\mu$ . with bicellular spores, soon dividing into subglobose loculi, 5-6  $\mu$  diam., and those of *Hypocrella Glaziovii* as 40-50  $\times$  10-15  $\mu$ , with pluriseptate filiform spores, 35-45  $\times$  3-4  $\mu$  which divide into part spores 5-8  $\times$  3-4  $\mu$ .

The fungus is circular, about 1 mm. diameter, flattened pulvinate, black-brown, on a slight brownish-white web of mycelium. In section it is brownish-white at the base, above which is a dark brown convex stroma, surmounted by a paler brown peripheral zone. The lower layers consist of interwoven thin-walled hyphæ, which become parallel in the dark brown zone, and bear an upper layer of asci and paraphyses about 0.2 mm. thick. The basal layer ascends slightly up the sides. The asci are 6-8  $\mu$  diameter, 4-spored, with a rounded, not thickened apex. The spores are 120-160  $\times$  3-4  $\mu$ , septate, with divisions 3-5  $\mu$  long, but do not show any signs of separation. The paraphyses are filiform, and fused above into an epithecium. This is evidently a Discomycete.

**Hypocrella marginalis** P. Henn., *Engl. Bot. Jahrb.* (1903), p. 49.

The type in Herb. Berlin, from East Africa, is a discomycete, co-generic with the foregoing ; the spores, as far as observed, are 1.5  $\mu$  diameter, with septa about 2  $\mu$  apart, but they appear to be immature. With the type is included a specimen from Rio Jurua (det. Hennings) which is identical with "*Hypocrella semen*."

**Hypocrella obconica** P. Henn., *Fungi goyazenses*, p. 106.

This, in the type specimen in Herb. Berlin, is a discomycete. It grew on decayed areas on the leaf, from a byssoid stroma. The hypothecium is well developed, and forms an infundibuliform cup filled with the obconic mass of asci. The spores appear to be filiform.

**Hypocrella juruana** P. Henn., *Hedwigia*, XLIV., p. 61.

The type specimen in Herb. Berlin is Ule 2,831, 2,832. Hennings described it as subdisceoid, pulvinate, convex or flattened, horny red-brown, 1-2 mm. diameter, granulato-ostiolate, pallid within; asci 150-200  $\times$  4-5  $\mu$ ; sporidia 1  $\mu$  diameter, as long as the ascus. After the description he stated that the stromata were, in general, quite immature, and only isolated sporiferous asci could be found. In the type specimen in Herb. Berlin the stromata are circular, flattened and lenticular, and as far as could be ascertained do not contain any perithecia. They are composed of thin-walled hyphæ and thus differ from *Hypocrella* in general, and they do not exhibit the characteristic *Hypocrella* scar. They appear similar to the barren stromata, common in the Eastern tropics, which Berkeley named (in Herb.) *Aschersonia zeylanica*. I have similar stromata from Trinidad *ex herb.* Thaxter.

**Hypocrella Moelleriana** P. Henn., *Hedwigia* (1897), p. 222.

Transferred to *Ascopolyporus* by Möller, *Phycomyceten und Ascomyceten*, p. 180.

**Moelleriella nutans** Rick, *Ann. Myc.*, II., p. 105.

This has already been referred to on p. 196.

**Hypocrella rubiginosa** A. L. Smith, *Jour. Linn. Soc.*, XXXV., p. 18.

This was described as occurring on the stroma of a *Hypoxylon*. The basal part, however, is not *Hypoxylon*, but *Munkia*.

Other specimens of *Munkia* examined by me exhibit, when dry, an outer "rind," about 1 mm. thick, in which the "pycnidia" are embedded, and this rind is continuous all over the stroma. In the specimen which bears *Hypocrella rubiginosa*, however, the outer rind is interrupted beneath the *Hypocrella* stroma, as is shown in Miss A. L. Smith's illustration. The inner radially-arranged hyphæ grow through this gap and form the *Hypocrella* stroma. It would appear that the tissues of the supposed two fungi are continuous, and that the ascigerous portion is to be regarded as the higher stage of the *Munkia*. The structure is quite different from what would be found in the case of a *Hypocrella* parasitic on a scale insect on another fungus.

The ascigerous stroma differs from *Hypocrella* in the character of its hyphæ. Its spores are continuous and multiseptate, but it is, of course, possible that they may ultimately fall into part-spores.

**Aschersonia mellea** B. & Br., *Jour. Linn. Soc.*, XIV., p. 89.

Examination of the type specimen shows that this is a small *Crepidotus*, pressed flat on the substratum: its spores measure 5-6  $\times$  3-4  $\mu$ .



**Aschersonia carpinicola** E. & D., Proc. Canad. Inst. (1897), p. 63.

This was described as "Stromate convexo, erumpente, 2 mm. circ., cortice interiore innato, epidermide lacerata laxè cincto, vivo carnuloso, succineo, sicco obscure rufescente, facile deciduo; peritheciis minutis stromate immersis, ostiolis papillatis atris erumpentibus; sporulis ellipticis hyalinis, 15-20  $\times$  6-8  $\mu$  basidiis brevibus. In cortice emortuo Carpinì americanæ, London et Dorchester, Canada.

The mode of growth described is totally different from that of *Aschersonia*. Professor R. Thaxter informs me that it has been correctly referred to *Discula Peckiana* Sacc. by Farlow, in Bibl. Index N. A. Fungi.

**Aschersonia Henningsii** Koord., Bot. Untersuch. (1907), p. 213.

Koorder's figure shows multiseptate spores, from which it is evident that his fungus was not *Aschersonia*. Only a minute fragment now remains of the type specimen, but it is clear from the remnant that it is the "*Microcera*" very commonly found on the scale insects, *Aspidiotus*, *Aonidia*, &c., in the tropics. This species has since been named *Microcera Fujikuroi* by Miyabe and Sawada. Its structure differs from that of *Microcera* proper, and it is proposed to institute for it a new genus, *Pseudomicrocera*. The species will then stand as *Pseudomicrocera Henningsii*.

**Aschersonia zeylanica** Berk., in Herb. Kew.

This is a purple-red lenticular stroma common on scale insects in the Eastern tropics. It is circular, up to 4 mm. diameter, and about 0.75 mm. thick in the centre. All specimens seen up to the present have been sterile. Its hyphæ differ from those of *Aschersonia*. "*Aschersonia* sp. indet." on *Saccopetalum*, Coll. Koorders, Java, in Herb. Berlin, is apparently the same thing.

**Aschersonia rufa** (B. & Br.) Sacc., Sylloge Fungorum, III., p. 619; *Myrosporium rufum* B. & Br., Jour. Linn. Soc., XIV., p. 85.

The type consists of minute, flattened, pulvinate, somewhat irregular stromata. It was described as "Placentæforme, rufum, nitidum, collabens; sporis subellipticis." Sections show that the "stroma" consists of a mass of irregularly-oval, spore-like bodies, about 12  $\times$  10  $\mu$ .

**Aschersoniopsis globosa** P. Henn.

As already recorded by von Höhnelt (Ann. Myc., IX., p. 171) this belongs to *Munkia* Speg. This is true of the type (E. Ulc. 788), as well as of Puttemans 792, in Herb. Berlin.

**Aschersonia macularis** Sydow, Philippine Journal of Science, IX., Sec. C., p. 187 (1914).—"Stromatibus epiphyllis, in maculis flavo-brunneolis usque 1 cm. diam., plus minus

distincte circinatim congeste, minutis, 100–200  $\mu$  diam., globulosis, margine albido alatis, ochraceis; pycnidiis omnino immersis; basidiis obtusis, 12–16  $\mu$  longis, 1.5–2  $\mu$  latis; sporulis oblongis, utrinque obtusis, continuis, hyalinis, 5–6  $\mu$  longis, 2–2.5  $\mu$  latis. Palawan, Taytay, Merrill 8,855, May. 1913. On living leaves of *Mischocarpus*."

I have examined, through the kindness of the Director, the half of this collection, Merrill, 8,855, which was retained by the Bureau of Science, Manila. The stromata, which are very small, bear some superficial resemblance to those of *Aschersonia Coffeæ*, but they do not yield any colour with potash. The stout basidia, as described above, also resemble those of *A. Coffeæ*. Sections, however, show that the fungus is not *Aschersonia*. The stromata are up to 0.6 mm. diameter, flattened-pulvinate or placentiform, 0.1–0.15 mm. high, irregularly circular, with a very narrow margin. They are formed by hyphæ, which break through the epidermis of the leaf in a stout bundle and spread out over its surface. The context of the stroma is compact, composed of interwoven hyphæ, and there are no pycnidia. The basidia cover the whole of the surface of the stroma, including the convex sides. It appears to be a Hyphomycete, near *Tubercularia*. The spots on the leaf, in the part of the specimen seen by me, have no necessary relation to the stromata. The latter are parasitic on the leaf, but their effect appears to be confined to a small brown region beneath each stroma.

*Aschersonia microspora* Sacc., Atti dell' Accad. Veneto-Trentino-Istriana, X. (1917), p. 81.

Specimens in Baker, Fungi Malayana, No. 304, on *Schizostachyum*, include circular, slightly convex, compact, pale brownish stromata, up to 1.5 mm. diameter, immature; and circular, white, flat, pruinose or fibrillose stromata, up to 2 mm. diameter. Some of the latter bear a central, orange mass of spores, others bear minute scattered masses, while on others the spores are not yet developed. When examined under a low power, the latter are seen to be covered by a white, powdery mould, which sometimes extends on to the leaf. This mould is apparently an *Oospora*, with narrow-oval spores borne terminally and laterally, about  $3 \times 1.5 \mu$ . The stromata which bear minute, scattered spore-masses have this mould between the latter. On the stromata with apparently normal spore-masses covering nearly the whole surface there is no pycnidium, but the spore-bearing surface is covered with densely-packed, erect basidia, up to 12  $\mu$  high; the spores in the mass above this are either globose, 1.5  $\mu$  diameter, or narrow-oval,  $2-4 \times 1.5 \mu$ ; at the edge of the stroma, the hyphæ of the *Oospora* can be distinguished.

This gathering appears to be an abnormal development of an *Aschersonia*, due to the parasitism of an *Oospora*, similar to the cases cited under *Aschersonia placenta*. The original *Aschersonia* appears to be *Aschersonia placenta*.

## BIBLIOGRAPHY.

- Bresadola, J. . . Genus *Moelleria* Bres. *critice disquisitum*.  
Bull. Soc. Bot. Italiana, 1897, pp. 291-292.
- Fawcett, H. S. . . Fungi Parasitic upon *Aleyrodes citri*. 1908.  
Contains a full bibliography of the subject,  
especially of American publications.
- Hennings, P. . . Die Gattung *Aschersonia* Mont. Festschrift  
für P. Ascherson. 1904, pp. 68-72.
- von Höhnelt, F. . . Fragmente zur Mykologie, VI., VII., VIII.,  
Mitt. (1909).
- Miyabe, K. and . . On Fungi Parasitic on Scale Insects found in  
Sawada, K. Formosa. Jour. Coll. Agriculture, Tohoku  
Imperial University, Sapporo, Japan, V.,  
pt. 3. (1913).
- Möller, A. . . Phycomyceten und Ascomyceten. 1901.
- Morrill, A. W. . . Natural Control of White Flies in Florida.  
and Back, E. A. U. S. Dept. of Agriculture. Bureau of  
Entomology, Bulletin No. 102.
- Parkin, J. . . Fungi Parasitic upon Scale-Insects (*Coccidæ*  
and *Aleurodidæ*). Annals Royal Botanic  
Gardens, Peradeniya, III., pp. 11-82 (1906).
- Petch, T. . . The Genera *Hypocrella* and *Aschersonia* :  
a preliminary note. Annals Royal Botanic  
Gardens, Peradeniya, V., pp. 521-537 (1914).
- Raciborski, M. . . Ueber die javanischen *Hypocreaceæ* und  
*Scolecosporæ*. Bull. Acad. Sci. Cracovie,  
December, 1906.
- Rick, J. . . Ueber einige auf Bambusarten wachsende  
tropische *Hypocreaceen*. Annales Myco-  
logici, II., pp. 402-406.
- Rick, J. . . Annales Mycologici, V., p. 29.
- Thaxter, R. . . Note on the Ascosporic Condition of the  
Genus *Aschersonia* Montagne. Botanical  
Gazette, LVII., pp. 308-313.
- Webber, H. J. . . Sooty Mould of Orange and its Treatment.  
Bull. No. 13, U. S. Dept. of Agriculture,  
Division of Vegetable Physiology and  
Pathology (1897).

## EXPLANATION OF PLATES.

## Plate II.

1. *Hypocrella palmæ*,  $\times 6$ ; specimen *ex type* of *Hypocrella globosa* Syd. in Herb. Berlin.
2. *Hypocrella olivacea*, flat form,  $\times 5$ ; Ceylon specimen.
3. *Hypocrella olivacea*, subglobose form,  $\times 5$ ; Ceylon specimen.
4. *Hypocrella cavernosa* (*Aschersonia* stage) viewed from above,  $\times 6$ ; specimen from Trinidad in Herb. Thaxter.
5. *Hypocrella Amomi*,  $\times 8$ ; specimen *ex type* in Herb. Raciborski.
6. *Hypocrella javanica*, smooth *Aschersonia* stage,  $\times 6$ ; specimen *ex type* of *Aschersonia Eugeniæ* Koord. in Herb. Berlin.
7. *Hypocrella Schizostachyi*,  $\times 2$ ; specimen *ex co-type* in Herb. Philippines.
8. *Hypocrella bispora*, half a stroma,  $\times 6$ ; specimen *ex type*, Herb. von Höhnelt.
9. *Hypocrella discoidea* (*Aschersonia* stage),  $\times 6$ ; Ceylon specimen.
10. *Hypocrella caulium* (*H. camerunensis*),  $\times 5$ ; specimen *ex type* of *H. camerunensis* in Herb. Berlin.
11. *Hypocrella javanica*,  $\times 6$ ; Ceylon specimen.
12. *Hypocrella ceramichroa*,  $\times 4$ ; Ceylon specimen.
13. *Hypocrella caulium* (*H. camerunensis* var. *brasiliانا*),  $\times 2$ ; specimen *ex type* of *H. camerunensis* var. *brasiliانا* in Herb. Berlin.
14. *Hypocrella Reineckeana* (eaten on one side and showing the internal colour of the stroma),  $\times 6$ ; Ceylon specimen.
15. *Hypocrella Reineckeana*, young form with "bloom,"  $\times 6$ ; Ceylon specimen.
16. *Aschersonia oxystoma*,  $\times 8$ ; Ceylon specimen.
17. *Hypocrella phyllogena*,  $\times 6$ ; specimen *ex Hypocrella sulphurea* Bres., St. Catherine's, coll. Ule.

18. *Hypocrella phyllogena* (*Aschersonia*),  $\times 10$  ; specimen *ex* Herb. Paris, Leprieur, Journ. second.
19. *Hypocrella turbinata* (*Aschersonia* stage, simple form),  $\times 6$  ; West Indies.
20. *Hypocrella Andropogonis*,  $\times 5$  ; specimen from Trinidad, Thaxter No. 18.
21. *Hypocrella scutata*, lower surface,  $\times 5$  ; specimen *ex* type Herb. Kew.
22. *Hypocrella turbinata* (*Aschersonia*, old specimen),  $\times 4$  ; West Indies.
23. *Hypocrella Reineckeana*, old specimen, partly in section,  $\times 4$  ; Ceylon specimen.

### Plate III.

24. *Hypocrella epiphylla* (*Aschersonia* = *A. cubensis*),  $\times 6$  ; Florida specimen.
25. *Hypocrella duplex* (*Aschersonia* stage, simple),  $\times 10$  ; specimen *ex* type in Herb. Kew.
26. *Hypocrella scutata*, viewed from above,  $\times 2$  ; specimen *ex* type in Herb. Kew.
27. *Hypocrella convexa*, viewed from above,  $\times 5$  ; specimen *ex* type Herb. Raciborski.
28. *Hypocrella epiphylla*,  $\times 8$  ; specimen *ex* type.
29. *Hypocrella duplex*,  $\times 8$  ; specimen *ex* type in Herb. Kew.
30. *Hypocrella Sloaneæ* (with *Aschersonia* stage),  $\times 12$  ; specimen *ex* type of *Hypocrella amazonica* P. Henn. in Herb. Berlin.
31. *Hypocrella palmicola*,  $\times 6$  ; specimen from Trinidad, *ex* Herb. Thaxter.
32. *Hypocrella palmicola* (*Aschersonia* stage),  $\times 10$  ; specimen from Trinidad, *ex* Herb. Thaxter.
33. *Aschersonia crenulata*,  $\times 6$  ; specimen *ex* type in Herb. Paris.
34. *Aschersonia brunnea*,  $\times 10$  ; specimen *sub* *Hypocrea amazonica* Cke. in Herb. Kew.
35. *Aschersonia tuitensis*,  $\times 12$  ; specimen *ex* type, Herb. Paris.



36. *Aschersonia Tamurai*.  $\times 10$  ; specimen from Japan, *ex* Herb. Sydow.
37. *Hypocrella viridans* (*Aschersonia* stage),  $\times 8$  ; specimen *ex* Herb. Speg., Fungi Puigg., No. 475.
38. *Hypocrella viridans* (*Aschersonia* stage),  $\times 8$  ; specimen *ex* type of *Aschersonia disciformis* Pat. in Herb. Patouillard.
39. *Hypocrella Raciborskii*,  $\times 8$  ; specimen from the Philippines.
40. *Hypocrella Sloaneæ*,  $\times 8$  ; specimen *ex* type of *Hypocrella amazonica* P. Henn. in Herb. Berlin.
41. *Aschersonia hypocreoidea*,  $\times 6$  ; Ceylon specimen.
42. *Hypocrella Mollii*,  $\times 6$  ; specimen *ex* type of *Hypocrella cretacea* in Herb. von Höhnelt.
43. *Aschersonia australiensis*,  $\times 10$  ; specimen *ex* type, Pritzel, No. 79.
44. *Aschersonia Aleurodis* (from old dried specimen),  $\times 10$  ; specimen from Florida, per H. S. Fawcett.
45. *Aschersonia placenta* (pulvinate form),  $\times 7$  ; Ceylon specimen.
46. *Aschersonia Goldiana*,  $\times 6$  ; specimen from H. J. Webber, Florida.
47. *Aschersonia badia*,  $\times 6$  ; specimen from the Philippines.
48. *Aschersonia placenta* (parasitized),  $\times 10$  ; Ceylon specimen.
49. *Hypocrella turbinato* (*Aschersonia* stage),  $\times 6$  ; West Indies.
50. *Hypocrella turbinata* (*Hypocrella* stage),  $\times 6$  ; Grenada. *ex* Herb. Thaxter.
51. *Aschersonia blumenaviensis*,  $\times 6$  ; specimen *ex* type of *A. flavocitrina* in Herb. Berlin.
52. *Aschersonia placenta* (two specimens confluent),  $\times 10$  ; Ceylon specimen.
53. *Hypocrella Andropogonis* (*Aschersonia* stage),  $\times 6$  ; specimen from Trinidad *ex* Herb. Thaxter.
54. *Hypocrella botryosa*,  $\times 8$  ; specimen *ex* type in Herb. Sydow.

*Sections of Stromata, &c., partly diagrammatic.*

**Plate IV.**

1. *Hypocrella palmæ* (*Fleischeria paulensis*, type),  $\times 3$ .
2. *Hypocrella palmæ* (*H. globosa* Syd., type),  $\times 3$ .
3. *Hypocrella phyllogena*, pulvinate form,  $\times 6$ .
4. *Hypocrella phyllogena* (*H. Edwalliana*, type),  $\times 6$ .
5. *Hypocrella phyllogena*, pulvinate pyrenidial form,  $\times 6$ .
6. *Hypocrella phyllogena* (*Moelleriella sulphurea*, type),  $\times 6$ .
7. *Hypocrella phyllogena*, ? parasitized, ex Herb. Theissen,  
 $\times 6$ .
8. *Hypocrella scutata*,  $\times 3$ .
9. *Hypocrella epiphylla*,  $\times 6$ .
10. *Hypocrella Reineckiana*, with tubular pyrenidia,  $\times 3$ .
11. *Hypocrella Reineckiana*,  $\times 6$ .
12. *Hypocrella caulium*,  $\times 3$ .
13. *Hypocrella caulium* var. *brasiliانا*,  $\times 4$ .
14. *Hypocrella cavernosa* (after Möller),  $\times 1\frac{1}{2}$ .
15. *Hypocrella verruculosa* (after Möller),  $\times 2$ .
16. *Hypocrella Gartneriana* (after Möller),  $\times \frac{2}{3}$ .
17. *Hypocrella Schizostachyi*, nat. size.
18. *Hypocrella botryosa*,  $\times 4$ .
19. *Hypocrella palmicola*,  $\times 4$ .
20. *Hypocrella bispora*,  $\times 6$ .
21. *Hypocrella Amomi*,  $\times 6$ .
22. *Hypocrella convexa*,  $\times 6$ .
23. *Hypocrella javanica*,  $\times 3$ .
24. *Hypocrella olivacea*,  $\times 3$ .
25. *Hypocrella olivacea*,  $\times 4$ .
26. *Hypocrella olivacea*,  $\times 4$ .
27. *Hypocrella ceramichroa* (type),  $\times 3$ .
28. *Hypocrella ceramichroa*,  $\times 3$ .
29. *Aschersonia oxystoma*,  $\times 6$ .
30. *Aschersonia oxystoma*,  $\times 6$ .
31. *Aschersonia cubensis*,  $\times 6$ .
32. *Aschersonia cubensis*,  $\times 3$ .
33. *Aschersonia turbinata*, small form,  $\times 6$ .
34. *Aschersonia turbinata*,  $\times 6$ .
35. *Hypocrella turbinata* (after Thaxter).

## Plate V.

- 35A. *Hypocrella discoidea* (*Aschersonia* stage),  $\times 4$ .
36. *Hypocrella Mollii*,  $\times 3$ .
37. *Hypocrella Mollii*,  $\times 4$ .
38. *Hypocrella Sloaneæ*,  $\times 4$ .
39. *Hypocrella Raciborskii*,  $\times 6$ .
40. *Hypocrella duplex*,  $\times 6$ .
41. *Aschersonia duplex*,  $\times 6$ .
42. *Aschersonia taitensis*,  $\times 10$ .
43. *Aschersonia placenta*, median cross section,  $\times 10$ .
44. *Aschersonia Aleyrodii*,  $\times 10$ .
45. *Aschersonia hypocreloidea*,  $\times 10$ .
46. *Aschersonia Goldiana*,  $\times 10$ .
47. *Aschersonia Tamurai*,  $\times 10$ .
48. *Aschersonia australiensis*,  $\times 10$ .
49. *Aschersonia viridans*,  $\times 6$ .
50. *Aschersonia badia*,  $\times 6$ .
51. *Aschersonia crenulata*,  $\times 10$ .
52. *Aschersonia blumenaviensis*,  $\times 5$ .
53. *Aschersonia brunnea*,  $\times 6$ .
54. Perithecium of *Hypocrella palmæ*,  $\times 100$ .
55. Apex of ascus and spores of *H. palmæ*,  $\times 600$ .
56. Formation of part spores of *H. Raciborskii*,  $\times 800$ .
57. Part-spores of *H. palmæ*,  $\times 900$ .
58. Part-spores of *H. phyllogena*,  $\times 900$ .
59. Part-spores of *H. Raciborskii*,  $\times 900$ .
60. Part-spores of *H. Amomi*,  $\times 900$ .
61. Pycnosporos of *H. phyllogena*,  $\times 1000$ .
62. Pycnosporos of *H. olivacea*,  $\times 1000$ .
63. Pycnosporos of *H. javanica*,  $\times 1000$ .
64. Pycnosporos of *H. turbinata*,  $\times 1000$ .
65. Pycnosporos of *A. oxystoma*,  $\times 1000$ .

## NAME INDEX.

[Synonyms and rejected or doubtful names are printed  
in italics.]

|                       |    |                                     |          |     |
|-----------------------|----|-------------------------------------|----------|-----|
| Aschersonia           |    | <i>juruensis</i>                    | ..       | 229 |
| <i>abnormis</i>       | .. | <i>lauricola</i>                    | ..       | 262 |
| <i>acutispora</i>     | .. | <i>lecanioides</i>                  | ..       | 243 |
| <i>Aleyrodis</i>      | .. | <i>macularis</i>                    | ..       | 268 |
| <i>amazonica</i>      | .. | <i>marginata</i>                    | ..       | 210 |
| <i>Andropogonis</i>   | .. | <i>mellea</i>                       | ..       | 267 |
| <i>australiensis</i>  | .. | <i>microspora</i>                   | ..       | 269 |
| <i>Ayresii</i>        | .. | <i>Napoleonæ</i>                    | ..       | 234 |
| <i>badia</i>          | .. | <i>novoguineensis</i>               | ..       | 243 |
| <i>basicystis</i>     | .. | <i>oxyspora</i>                     | 229, 233 |     |
| <i>blumenaviensis</i> | .. | <i>oxystoma</i>                     | ..       | 233 |
| <i>brunnea</i>        | .. | <i>paraensis</i>                    | ..       | 257 |
| <i>carpinicola</i>    | .. | <i>paraphysata</i>                  | ..       | 262 |
| <i>chaetospora</i>    | .. | <i>paraphysata</i> f. <i>Balan-</i> |          |     |
| <i>chelonix</i>       | .. | <i>seana</i>                        | ..       | 256 |
| <i>cinnabarina</i>    | .. | <i>parasitica</i>                   | ..       | 248 |
| <i>Coffeæ</i>         | .. | <i>pediculoides</i>                 | ..       | 220 |
| <i>columnifera</i>    | .. | <i>phthiurioides</i>                | ..       | 238 |
| <i>confluens</i>      | .. | <i>pisiformis</i>                   | ..       | 210 |
| <i>consociata</i>     | .. | <i>Pittieri</i>                     | ..       | 226 |
| <i>crenulata</i>      | .. | <i>placenta</i>                     | ..       | 243 |
| <i>cubensis</i>       | .. | <i>Puttemansii</i>                  | ..       | 229 |
| <i>disciformis</i>    | .. | <i>rufa</i>                         | ..       | 268 |
| <i>duplex</i>         | .. | <i>samoensis</i>                    | ..       | 234 |
| <i>Eugeniæ</i>        | .. | <i>sclerotoides</i>                 | ..       | 210 |
| <i>flava</i>          | .. | <i>Suzukii</i>                      | ..       | 220 |
| <i>flavocitrina</i>   | .. | <i>taitensis</i>                    | ..       | 253 |
| <i>Goldiana</i>       | .. | <i>Tamurai</i>                      | ..       | 253 |
| <i>guianensis</i>     | .. | <i>tephrosiicola</i>                | ..       | 251 |
| <i>Henningsii</i>     | .. | <i>turbinata</i>                    | ..       | 226 |
| <i>hypocreoidea</i>   | .. | <i>viridans</i>                     | ..       | 236 |
| <i>Jacarandæ</i>      | .. | <i>viridula</i>                     | ..       | 236 |
| <i>javanica</i>       | .. | <i>Zenkeri</i>                      | ..       | 255 |

|                        |      |     |                                      |      |     |
|------------------------|------|-----|--------------------------------------|------|-----|
| <i>zeylanica</i>       | ..   | 268 | <i>discoidea</i>                     | ..   | 234 |
| <i>Aschersoniopsis</i> |      |     | <i>epiphylla</i>                     | ..   | 208 |
| <i>globosa</i>         | ..   | 268 | <i>palmæ</i>                         | ..   | 204 |
| <i>Balansia</i>        |      |     | <i>phyllogena</i>                    | ..   | 228 |
| <i>axillaris</i>       | ..   | 264 | <i>scutata</i>                       | ..   | 216 |
| <i>Bambusæ</i>         | ..   | 264 | <i>semiamplexa</i>                   | ..   | 266 |
| <i>hypoxylon</i>       | ..   | 265 | <i>tuberiformis</i>                  | ..   | 265 |
| <i>Panici</i>          | ..   | 265 | <i>variabilis</i>                    | 238, | 250 |
| <i>Balansiella</i>     |      |     | <i>viridans</i>                      | ..   | 236 |
| <i>pulvinula</i>       | ..   | 265 | <i>Hypocrella</i>                    |      |     |
| <i>Barya</i>           |      |     | <i>abnormis</i>                      | ..   | 228 |
| <i>salaccensis</i>     | ..   | 243 | <i>amazonica</i>                     | ..   | 249 |
| <i>Corticium</i>       |      |     | <i>ambiens</i>                       | ..   | 204 |
| <i>caulium</i>         | ..   | 212 | <i>Amomi</i>                         | ..   | 223 |
| <i>Discula</i>         |      |     | <i>Andropogonis</i>                  | ..   | 247 |
| <i>Peckiana</i>        | ..   | 268 | <i>atramentosa</i>                   | ..   | 265 |
| <i>Dothichloe</i>      |      |     | <i>axillaris</i>                     | ..   | 264 |
| <i>atramentosa</i>     | ..   | 265 | <i>Bambusæ</i>                       | ..   | 264 |
| <i>Dussiella</i>       |      |     | <i>bispora</i>                       | ..   | 218 |
| <i>tuberiformis</i>    | ..   | 265 | <i>botryosa</i>                      | ..   | 224 |
| <i>Epichloe</i>        |      |     | <i>camerunensis</i>                  | ..   | 213 |
| <i>hypoxylon</i>       | ..   | 265 | <i>camerunensis</i> var. <i>bra-</i> |      |     |
| <i>pulvinulus</i>      | ..   | 264 | <i>siliana</i>                       | ..   | 213 |
| <i>Fleischeria</i>     |      |     | <i>caulium</i>                       | ..   | 212 |
| <i>javanica</i>        | ..   | 220 | <i>cavernosa</i>                     | ..   | 215 |
| <i>paulensis</i>       | ..   | 204 | <i>ceramichroa</i>                   | ..   | 214 |
| <i>purpurea</i>        | ..   | 223 | <i>citrina</i>                       | 228, | 260 |
| <i>sclerotoides</i>    | ..   | 207 | <i>colliculosa</i>                   | ..   | 260 |
| <i>Fusarium</i>        |      |     | <i>convexa</i>                       | ..   | 217 |
| <i>hypocreoidium</i>   | ..   | 255 | <i>coronata</i>                      | ..   | 228 |
| <i>salmonicolor</i>    | ..   | 258 | <i>cretacea</i>                      | ..   | 238 |
| <i>Glaziella</i>       |      |     | <i>cyperacearum</i>                  | ..   | 266 |
| <i>ceramichroa</i>     | ..   | 214 | <i>discoidea</i>                     | ..   | 234 |
| <i>Hypocrea</i>        |      |     | <i>duplex</i>                        | ..   | 240 |
| <i>amazonica</i>       | 229, | 236 | <i>Edwalliana</i>                    | ..   | 228 |
| <i>armeniaca</i>       | ..   | 222 | <i>Engleriana</i>                    | ..   | 263 |
| <i>atramentosa</i>     | ..   | 265 | <i>epiphylla</i>                     | ..   | 208 |
| <i>Bambusæ</i>         | ..   | 264 | <i>flicina</i>                       | ..   | 204 |
| <i>cyperacearum</i>    | ..   | 266 | <i>Gardeniæ</i>                      | ..   | 263 |



|                       |      |     |                       |      |     |
|-----------------------|------|-----|-----------------------|------|-----|
| <i>Gartneriana</i>    | ..   | 222 | <i>Reineckiana</i>    | ..   | 209 |
| <i>Glaziovii</i>      | ..   | 266 | <i>rubiginosa</i>     | ..   | 267 |
| <i>globosa</i>        | 204, | 261 | <i>Schizostachyi</i>  | ..   | 223 |
| <i>Grewiæ</i>         | ..   | 234 | <i>scutata</i>        | ..   | 216 |
| <i>guaranitica</i>    | ..   | 204 | <i>semen</i>          | ..   | 266 |
| <i>hypoxylon</i>      | ..   | 265 | <i>semiamplexa</i>    | ..   | 266 |
| <i>javanica</i>       | ..   | 220 | <i>Sloaneæ</i>        | ..   | 249 |
| <i>juruana</i>        | ..   | 267 | <i>Spegazzinii</i>    | ..   | 204 |
| <i>luteo-olivacea</i> | ..   | 261 | <i>Sydouii</i>        | ..   | 204 |
| <i>marginalis</i>     | ..   | 266 | <i>Tamoneæ</i>        | ..   | 263 |
| <i>melæna</i>         | ..   | 210 | <i>tuberiformis</i>   | ..   | 265 |
| <i>Moelleriana</i>    | ..   | 267 | <i>tubulata</i>       | ..   | 241 |
| <i>Mollii</i>         | ..   | 238 | <i>turbinata</i>      | ..   | 225 |
| <i>nectrioides</i>    | ..   | 225 | <i>verruculosa</i>    | ..   | 219 |
| <i>obconica</i>       | ..   | 267 | <i>viridans</i>       | ..   | 236 |
| <i>ochracea</i>       | ..   | 228 | <i>Warneckiana</i>    | ..   | 243 |
| <i>olivacea</i>       | ..   | 206 | <i>Weberbaueri</i>    | ..   | 228 |
| <i>orbicularis</i>    | ..   | 204 | <i>Zimmermanniana</i> | ..   | 234 |
| <i>oxystoma</i>       | ..   | 232 | <i>Zingiberis</i>     | ..   | 234 |
| <i>palmae</i>         | ..   | 204 | <i>Hypoxylon</i>      |      |     |
| <i>palmicola</i>      | ..   | 237 | <i>ceramichroum</i>   | ..   | 214 |
| <i>Panici</i>         | ..   | 265 | <i>Moelleriella</i>   |      |     |
| <i>Pernettyæ</i>      | ..   | 210 | <i>nutans</i>         | ..   | 267 |
| <i>phyllogena</i>     | ..   | 228 | <i>sulphurea</i>      | ..   | 228 |
| <i>phyllophila</i>    | ..   | 204 | <i>Munkia</i>         | 267, | 268 |
| <i>pulvinulus</i>     | ..   | 264 | <i>Myrosporium</i>    |      |     |
| <i>Raciborskii</i>    | ..   | 242 | <i>rufum</i>          | ..   | 268 |
| <i>Randiæ</i>         | ..   | 220 |                       |      |     |



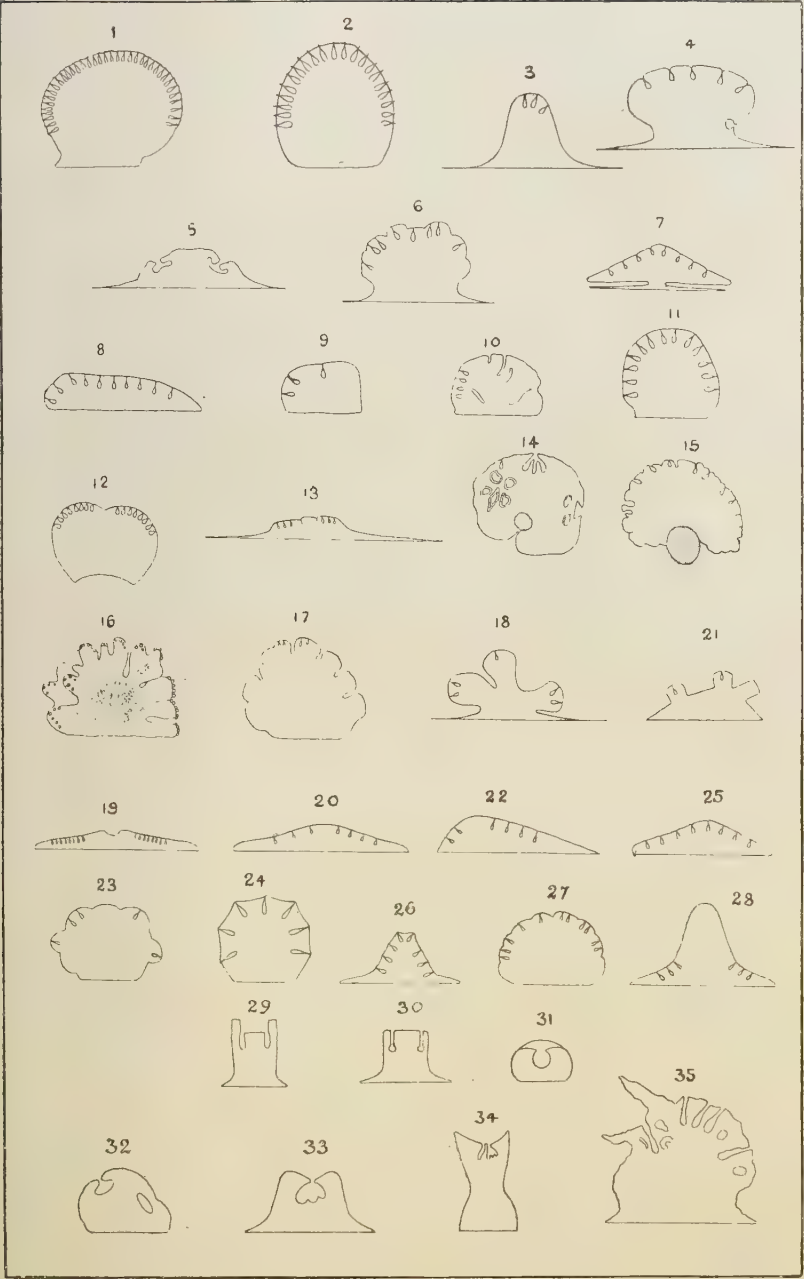




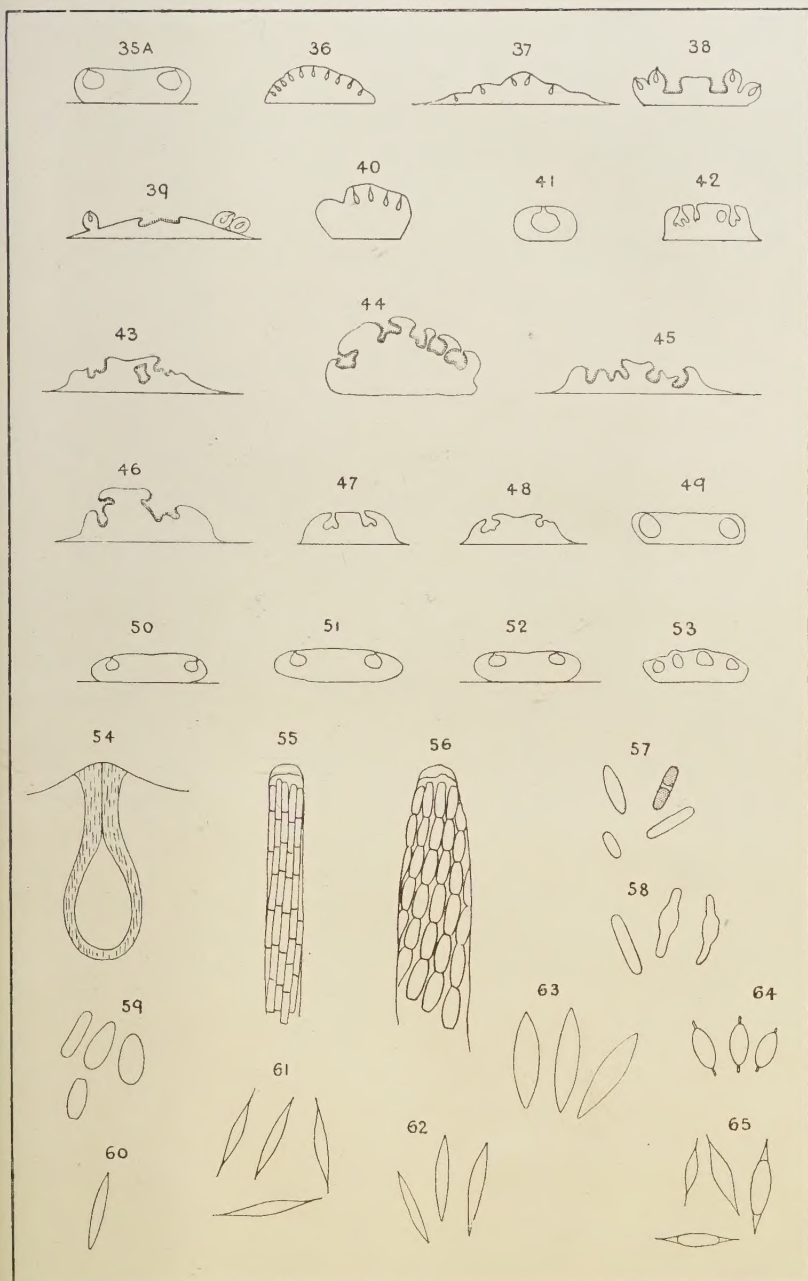
HYPOCRELLA AND ASCHERSONIA













# NOTICE.

The following reprints are for sale at the prices marked :—

|                                                                                                                                | Rs. | c. |
|--------------------------------------------------------------------------------------------------------------------------------|-----|----|
| Willis : A Revision of the Podostemaceæ of India and Ceylon,<br>70 pages .. ..                                                 | 1   | 50 |
| Willis : Studies in the Morphology and Ecology of the Podostemaceæ, &c., 200 pages, 33 plates ..                               | 7   | 50 |
| Lock : Studies in Plant Breeding in the Tropics : II., Experiments with Peas, 58 pages ..                                      | 2   | 0  |
| Lock : On the Growth of Giant Bamboos, &c., 56 pages, 3 plates ..                                                              | 2   | 0  |
| Wright : The Genus Diospyros in Ceylon, &c., 185 pages, 20 plates ..                                                           | 6   | 0  |
| Parkin : Fungi parasitic upon Scale-Insects, 72 pages, 4 plates                                                                | 3   | 0  |
| Petch : The Fungi of certain Termite Nests, 86 pages, 17 plates                                                                | 5   | 0  |
| Smith : On the Application of the Theory of Limiting Factors to Measurements and Observations of Growth in Ceylon, 73 pages .. | 2   | 0  |
| Willis : The Flora of Ritigala, 32 pages ..                                                                                    | 1   | 0  |
| Willis : The Geographical Distribution of the Dilleniaceæ, &c., 9 pages ..                                                     | 0   | 25 |
| Willis : Further Evidence against the Origin of Species by Infinitesimal Variations, 4 pages ..                                | 0   | 25 |
| Petch : Revisions of Ceylon Fungi, 48 pages ..                                                                                 | 1   | 0  |
| Smith : The Effect of the Moon's Phases on the Period of Felling Bamboos, 6 pages ..                                           | 0   | 25 |
| Jowitt : Note on <i>Apluda varia</i> Hack, 4 pages, and figures ..                                                             | 0   | 25 |
| Willis : The Floras of Hill Tops in Ceylon, 8 pages ..                                                                         | 0   | 25 |
| Lock : Notes on certain Seedlings of Cymbopogon, &c., 6 pages ..                                                               | 0   | 25 |
| Willis & } Corrections and Additions to Trimen's "Flora of<br>Smith } Ceylon," 1893-1911, 40 pages ..                          | 1   | 0  |
| Lock : Notes on Colour Inheritance in Maize, 8 pages ..                                                                        | 0   | 25 |



# CEYLON PUBLICATIONS.

FOR SALE AT THE GOVERNMENT RECORD OFFICE, COLOMBO.

| Oriental Literature.                             |    | Rs. c. |                                              |  | Rs. c. |
|--------------------------------------------------|----|--------|----------------------------------------------|--|--------|
| The Mahawansa, original Pali edition ..          | 10 | 0      | Architectural Remains of Anuradhapura        |  |        |
| The Mahawansa, English translation               |    |        | (with plates), by J. G. Smither :—           |  |        |
| (Turnour and Wijesinha) ..                       | 7  | 50     | In boards ..                                 |  | 40 0   |
| The Mahawansa, translations of Chapters          |    |        | In cloth ..                                  |  | 60 0   |
| I. to XXXVII., by Dr. W. Geiger ..               | 10 | 0      | Return of Architectural and Archæological    |  |        |
| The Mahawansa, Sinhalese Translation,            |    |        | Remains, &c., in Ceylon ..                   |  | 1 20   |
| Parts I. and II. .. each Part                    | 5  | 0      | Reports on the Archæological Survey of       |  |        |
| The Mahawansa Tika, with original Pali           |    |        | Ceylon :—                                    |  |        |
| Index to Mahawansa, together with a              |    |        | Kegalla District ..                          |  | 6 0    |
| Chronological Table of Wars and Genea-           |    |        | Anuradhapura (I.) ..                         |  | 0 50   |
| logical Trees ..                                 | 1  | 0      | Do. (II.) ..                                 |  | 1 0    |
| Dipavamsa and Mahavamsa ..                       | 1  | 50     | Do. (III.) ..                                |  | 1 65   |
| The Rajavaliya (English and Sinhalese),          |    |        | Do. (IV.) ..                                 |  | 1 0    |
| each ..                                          | 0  | 75     | Do. (V.) ..                                  |  | 2 20   |
| Extracts from the Pujavaliya (English) ..        | 1  | 0      | Do. (VII.) ..                                |  | 4 0    |
| Do. do. (Sinhalese) ..                           | 0  | 75     | Annual Reports, 1890-1901 .. each            |  | 0 50   |
| Nitinighanduwa (Sinhalese) ..                    | 1  | 0      | Do. 1902 ..                                  |  | 2 50   |
| Kawsilumina (Sinhalese) ..                       | 1  | 50     | Do. 1903 ..                                  |  | 3 0    |
| Rajaratnakaraya (Sinhalese) ..                   | 0  | 50     | Do. 1904 ..                                  |  | 1 0    |
| Nikaya Sangrahawa (English) ..                   | 0  | 50     | Do. 1905 to 1909 .. each                     |  | 4 0    |
| Do. (Sinhalese) ..                               | 0  | 25     | Do. 1910-11 ..                               |  | 6 0    |
| Mugdhabodha Wyakarana (Sanskrit                  |    |        | Do. 1911-12 ..                               |  | 7 50   |
| Grammar) ..                                      | 5  | 0      | Do. 1912-13 ..                               |  | 1 0    |
| Catalogue of Pali, Sinhalese, and Sanskrit       |    |        | Summary, 1890-1900, with Maps and            |  |        |
| Manuscripts in Temple Libraries ..               | 0  | 50     | Plans ..                                     |  | 2 50   |
| Catalogue of Pali, Sinhalese, and Sanskrit       |    |        | Plans and Plates for 1892-94 Reports ..      |  | 21 0   |
| Manuscripts in the Colombo Museum                |    |        | Do. 1895-02 Reports ..                       |  | 21 0   |
| Library ..                                       | 1  | 0      | Do. 1903-1912 ..                             |  | 10 50  |
| Catalogue of the Colombo Museum                  |    |        | Epigraphia Zeylanica, Vol. I., Parts II.     |  |        |
| Library: Printed Books ..                        | 1  | 0      | to VI., and Vol. II., Parts I., II., III.,   |  |        |
| Supplement No. 1 ..                              | 0  | 75     | and IV. .. each Part                         |  | 4 0    |
| Supplement No. 2 ..                              | 0  | 75     | Natural History.                             |  |        |
| Alwis's Descriptive Catalogue of Sanskrit,       |    |        | The Flora of Ceylon, by Dr. Trimen :—        |  |        |
| Pali, and Sinhalese Works (Vol. I.) ..           | 5  | 0      | Parts III., IV., V. (with plates), each      |  | 20 0   |
| The Tesawalamai ..                               | 0  | 50     | The Kitul Palm and its Uses ..               |  | 0 10   |
| Pybus's Mission to Kandy ..                      | 0  | 50     | Coconut Cultivation (in Sinhalese) ..        |  | 0 50   |
| Papers on the Custom of Polyandry as             |    |        | Lepidoptera of Ceylon, in 13 Parts (with     |  |        |
| practised in Ceylon ..                           | 0  | 15     | coloured plates) .. each                     |  | 14 50  |
| Mediæval Sinhalese Art ..                        | 55 | 0      | Report on the Ceylon Pearl Fisheries ..      |  | 1 35   |
| Notes on Kandyan Chiefs and their Dresses        | 2  | 0      | Prof. Herdman's Report, Vols. 1 to 5, each   |  | 15 0   |
| Old Sinhalese Embroidery ..                      | 0  | 45     | Marine Biological Reports, Parts IV.,        |  |        |
| Archæology, &c.                                  |    |        | V., and VI. .. each                          |  | 2 0    |
| Dr. Müller's Report on Inscriptions of Ceylon :— |    |        | District Manuals.                            |  |        |
| Text ..                                          | 5  | 0      | Nuwara Eliya, by C. J. R. Le Mesurier ..     |  | 5 0    |
| Plates ..                                        | 5  | 0      | Vanni Districts, by J. P. Lewis ..           |  | 5 0    |
|                                                  |    |        | Puttalam District, by F. Modder, F.R.G.S. .. |  | 2 50   |
|                                                  |    |        | Rs. c.                                       |  |        |
| Ceylon Blue Book ..                              |    |        | ..                                           |  | 10 0   |
| Administration Reports (annual volumes) ..       |    |        | ..                                           |  | 10 0   |
| Sessional Papers, bound volumes ..               |    |        | .. Rs. 7-50 and 10 0                         |  | 0      |